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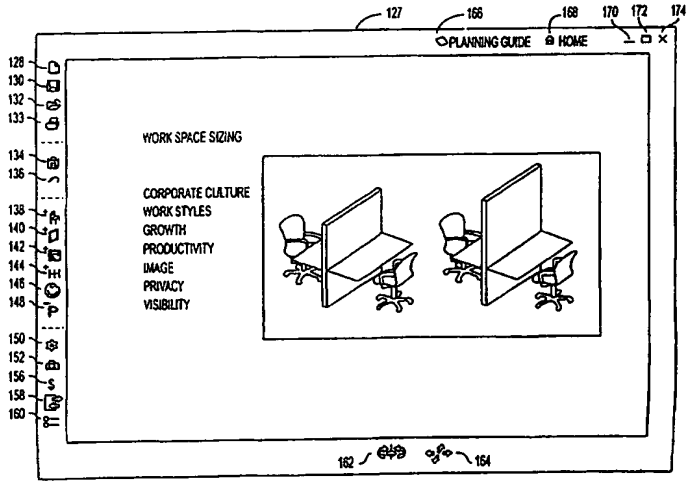

(57) Abstract

A graphical user interface to a method and system for configuring office furniture includes interface objects for obtaining configuration criteria from a user; presenting the user with at least one typical configuration satisfying the criteria; selecting a typical configuration from the at least one typical configuration; modifying aspects of the selected typical configuration to produce a modified configuration; and checking the validity of the modified configuration. The configuration criteria include conferencing criteria; privacy criteria; power criteria; communications criteria; storage criteria; and area criteria. A typical configuration can be modified by adding, deleting, or repositioning a component, changing the fabric or finish or the shape or size of the component. A cluster configuration based on the typical configuration is formed. The entire product line can be changed. At any time the entire typical or cluster configuration can be checked for validity and priced.

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GRAPHICAL USER INTERFACE SUPPORTING METHOD AND SYSTEM FOR REMOTE ORDER GENERATION OF OFFICE FURNITURE PRODUCTS

BACKGROUND OF THE INVENTION

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2. Field of Invention

This invention relates to graphical user interface supporting a method and system for enabling the selection and configuration of complex furniture products. More specifically, this invention relates to enabling the selection and configuration of three-dimensional office furnishing products so as to enable remote order generation of valid and acceptable configurations of those products.

3. Description of Background Information

The sale process for complex products, that is, products that are made up of many interconnected parts, is notoriously difficult, especially when customers are given configuration and product-line choices.

For example, in the office furniture industry, the goal of the sale process is to provide the customer with an acceptable furniture configuration within the customer's price limitations.

From the customer's perspective, an acceptable configuration is one which will provide workspace for their employees within various work-related and space criteria set by the customer. For example, a customer may need to provide, in a given area, sitting work space for a thousand people, where all people have acoustic privacy. A customer's criteria may be complex and often the customer does not really know what they are, other than to know the number of people and the space they will go into.

From the manufacturer's perspective, an acceptable configuration is one which can be manufactured from the manufacturer's product line. That is, an acceptable configuration is a valid, manufacturable configuration of existing component parts.

The sales process is essentially an attempt to reach a convergence on a configuration which is

acceptable to the customer (meets all space, price and other requirements) and which is acceptable to the manufacturer (is a valid configuration which is manufacturable).

An office workspace configuration may comprise thousands of parts drawn from an inventory of millions of possible parts. Each workspace may comprise dividing walls or side panels, work surfaces, storage areas, support structure, electrical structure and the like. Even for a given configuration of workspace, there are various qualitative and quantitative options available. Each part may be available in various qualities and in various colors. Some of the parts may not be compatible with parts from other product lines of the same or other manufacturers. Further, any choice made, even for a single part, may affect the entire configuration.

A customer wishing to buy a complex product such as office furniture is faced with an incredible number of interdependent choices.

In the office furniture market at present, a typical sale takes place as follows: A salesperson visits a customer and presents the customer with drawings of some typical configurations of various product lines. The customer selects various options which the salesperson records. At this time all of the

sale is taking place in terms of individual parts and not in terms of the final product or even in terms of compound components of the final product. In other words, the customer does not buy a collection of workstations, instead he buys a collection of parts.

Once the customer is satisfied with the configuration, the salesperson goes back to the manufacturer who determines whether or not the configuration is actually possible given the current product line. For example, the customer may have put a shelf on a dividing panel without confirming that the panel could actually support such a shelf. Or a panel may be given a size which the manufacturer does not or cannot manufacture. Accordingly, the manufacturer then tries to build the customer's proposed order using a CAD (computer aided design) system and a collection of known parts. Errors in the customer's proposed order are reported and, in some cases, a best attempt at the order is drawn up. From this best attempt produced by the CAD operators, a list of required component parts is obtained and then a price for the entire configuration is determined for all of the component parts.

This process, so far, can take more than two weeks. The sales person then goes back to the customer with the design, as best it could be done, and the

price for this design. This is the first time that the customer sees his actual order drawn out, and usually in two-dimensions. If there were errors in the design, which there usually are, or if the customer does not like the current design, the process is repeated.

After some number of iterations (that is customer to sales person to CAD operator to pricing and back to the customer via the sales person), the customer is finally presented with an acceptable configuration and a price for that configuration.

In a typical sales scenario this whole order process (i.e., convergence to a configuration which is acceptable to both the customer and the manufacturer) takes six sales calls and design iterations.

Even when the customer is satisfied with a configuration and even if it is a valid, manufacturable configuration, there is no simple way for anyone to go back and ask a simple "what if" type of question about the order. For instance, if, in an order for an acceptable configuration, the customer wants to know the effect on price of changing to a different quality panel system, the whole price would have to be redetermined by the manufacturer.

To see why this pricing and configuration process is not simple, consider the change from a high quality panel to a lower quality panel of the otherwise same

dimensions. Suppose that the panel has a shelf hanging on it and that the high quality panel can support shelves whereas the lower quality panel cannot support shelves without an extra support. So, a supposedly simple question like "What if I use this type of panel instead of that?" can lead to an entire reconfiguration and repricing of the system. Its often not enough to just change the price of the components being used, sometimes the components themselves have to be supplemented. In some cases, changes may not be possible.

Even from a salesperson's perspective, the inability to price "what if" scenarios has major drawbacks. For instance, if a customer is satisfied with a configuration's layout but still thinks that the price is too high, it is desirable for the salesperson to be able to make qualitative changes to the configuration and show what the corresponding price changes would be. In the case of office furnishings, a salesperson would like to be able to show, at the customer's site and at the time of setting up the configuration, the effects on price of various changes. In that way, convergence to an acceptable configuration can be achieved with greater speed.

In the general field of product configuration, tools have been developed to aid in selection and

validation of configurations. One such system is available from Trilogy Development Group of Austin, Texas, and is described in United States Patent No. 5,515,524, "Method and Apparatus for Configuring Systems," to Lynch et al, which is expressly incorporated herein by reference in its entirety.

Lynch describes a constraint based configuration system using a structural model hierarchy. The structural aspects of the model provide the system with the ability to define a model element as being contained in, or by, another model element. The structural model provides the ability to identify logical datatype and physical interconnections between elements and to establish connections between elements.

In order to configure a product, Lynch's system accepts input in the form of requests or needs. Using this information, Lynch's system configures a system by identifying the resource and component needs, constraints imposed on or by the resources or components identified, and the structural aspects of the system.

In the specific area of office furniture configuration, attempts have been made to provide customers with simple CAD systems with which to design their configurations. The problems with these systems include that they are difficult to use, they are

inaccurate, they do not provide the customer with a way to determine whether or not he has a valid, manufacturable configuration (so the customer still has to go back to the manufacturer to have configurations manually checked), and they do not have any knowledge of the manufacturer's product line. Further, no proposed systems are able to prepare a configuration and provide a price for that configuration.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an order generation system, preferably a remote order generation system.

It is a further object of this invention to provide sales people and customers with product configuration systems that are easy to use, accurate, provide the customer with some way to determine whether or not he has a valid, manufacturable configuration (so that the customer does not have to go back to the manufacturer to have configurations checked each time they change), and that has knowledge of the manufacturer's product line. It is a further object of this invention to provide a system that is able to prepare a configuration and that is also able to provide a price for that configuration.

It is also an object of this invention to provide a system that can have product line and price information added and modified.

It is also an object of this invention to provide a system that generates visual specification in two-dimensional (2-D) and three-dimensional (3-D) rendered images.

Accordingly, in one aspect, this invention provides a graphical user interface to a computer program for configuring and ordering office furniture. The user interface presents a user with various selectable options, via display screens on a monitor. Depending upon which options the user selects, the graphical user interface provides the user with information about the product selected or gets input from the user about his requirements.

The user can interact with the order generation program via the user interface to select a basic configuration of furniture, modify the configuration, create a cluster derived from the basic configuration. At all times the user is able to ensure that the current configuration is valid (i.e., manufacturable and/or within the product line) and the user is able to obtain price information about the configuration.

The system takes as input user criteria such as conferencing criteria; privacy criteria; power

criteria; communications criteria; storage criteria; and area criteria.

The user, via the user interface, can modify a configuration by adding, deleting or moving components in the configuration or by changing the size or shape of a component of the configuration. When the shape or size of a component is adjusted, it can only be changed to a valid shape or size, thereby maintaining the integrity of the displayed furniture configuration.

Generally, at any stage of the furniture configuration, the user is able to obtain a realistic display of the configuration and is then able to view that display from arbitrary view points.

Thus, in one aspect, this invention is a graphical user interface, a method for using the graphical user interface, or a method of configuring office furniture. In another aspect, this invention is computer-readable media tangibly embodying an interface program of instructions executable by the machine to provide a graphical user interface to a computer program for configuring office furniture.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features, and advantages of the present invention are further described in the detailed description which follows,

with reference to the drawings by way of non-limiting exemplary embodiments of the present invention, wherein like reference numerals represent similar parts of the present invention throughout the several views and wherein:

FIGURE 1 depicts a typical computer system on which the order generator of this invention operates;

FIGURE 2 shows the architecture of a preferred embodiment of the order generator according to this invention;

FIGURE 3 shows the architecture of an alternative preferred embodiment of the order generator according to this invention;

FIGURE 4 is a flowchart of the operation, from a user's perspective, of the order generator of the present invention; and

FIGURES 5-15 depict various interface displays of the order generator of the present invention during its operation.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EXEMPLARY EMBODIMENTS

This invention operates on a typical computer system 100 such as shown in FIGURE 1. The computer system 100 includes various input devices 102 such as a keyboard, as well as a pointer device 104. A mouse,

track ball, touch screen, keyboard cursor control keys or the like can be employed as the pointer device **104**. The computer system **100** also includes a processor such as CPU **106** and internal memory **108**. The processor **106** may be a special purpose processor with image processing capabilities or it may be a general purpose processor. The memory **108** may comprise various types of memory, including RAM, ROM, and the like. The computer system **100** also includes external storage **112** which includes devices such as disks, CD ROMs, ASICs, external RAM, external ROM and the like.

The present invention can be implemented as part of the processor **106** or as a program residing in memory **108** (and external storage **112**) and running on processor **106**, or as a combination of program and specialized hardware. When in memory **108** and/or external storage **112**, the program can be in a RAM, a ROM, an internal or external disk, a CD ROM, an ASIC or the like. In general, when implemented as a program or in part as a program, the program can be encoded on any computer-readable medium or combination of computer-readable media, including but not limited to a RAM, a ROM, a disk, an ASIC, a PROM and the like.

The computer system **100** also includes a display **110** and, optionally, an output device such as a printer **113**.

The computer system **100** can run any operating system.

In preferred embodiments, the computer system **100** is an IBM PC compatible notebook computer configured with a Pentium 90 (or above) CPU (for processor **106**) and, (for memory **108**) a minimum of sixteen Mbytes RAM, a CD drive and a hard drive with 840 Mbytes, with approximately thirty Mbytes of free disk space (for external storage **112**). The computer system **100** preferably runs Microsoft Windows 95 as its operating system.

The preferred display **110** is an 800 x 600 active color matrix display with sixteen-bit color. The preferred printer **112** is at least an ink jet color printer.

While the preferred computer system is a stand-alone system, in other embodiments the computer system **100** is connectable to a network of computers so that some or all of its processing functions, for example, for complex tasks, can be off loaded to other computers on the network. In network environments some or all of the data may reside at remote locations.

The architecture of a preferred embodiment of the order generator is shown in FIGURE **2** wherein the order generator **114** uses a modelling tool **116** connected to a custom user interface **118**. Both the modelling tool **116**

and the custom user interface **118** access (read and/or write) various databases, including a product attribute database **120**. The user interface **118** also accesses a meta file **121** which it uses to share data through a symbol library **123** with a CAD package **124**.

The modelling tool **116** takes as input various user configuration specifications via the custom user interface **118**, verifies their validity and determines their pricing. This information can be passed back to the custom user interface **118** or it can be used by a project specifier **122**, in conjunction with the CAD package **124**, to produce an actual order **125**. The project specifier **122** also takes input from a product catalog **129** in order to produce the actual order **125**.

In one aspect, the custom user interface **118** operates as a front-end to the modelling tool **116**, providing it with user requirements, user specified furniture configurations and other information and obtaining from it configuration information including whether or not a configuration is valid and the price of the configuration.

Preferably the modelling tool **116** is one which uses a generative approach for configuring systems. Such a system is available from Trilogy Development Group of Austin, Texas, and is described in United States Patent No. 5,515,524, "Method and Apparatus for

Configuring Systems," to Lynch et al, already incorporated by reference herein in its entirety.

Lynch's system, in order to configure a product, accepts input in the form of requests or needs. Using this information, Lynch's system configures a system by identifying the resource and component needs, constraints imposed on or by the resources or components identified, and the structural aspects of the system.

Thus, in the present invention, the modelling tool 116 is programmed to configure office furniture systems by identifying the component needs, resources, and constraints imposed on or by the resources or components identified, and the structural aspects of the system. For example, a particular storage requirement may require a certain type of panel. If a user requires that type of storage then the appropriate type of panel must be used.

The model can handle both configuration and checking functions. In the preferred embodiment, three-dimensional objects and their topological relationships are modelled. The attributes modeled include, but are not limited to:

size (x, y, z dimensions);

color;

texture;

finish (fabric/direction, wood/direction, laminate, glass, metal);

obsolescence;

power (electric); and

weight.

The modelling system **116** can connect workstations, recognize and fix common walls, resolve component duplication and overlap, indicate obstacles and resolve power connectivity. For example, with regard to panel connectivity, angles are confined to a limited number of fixed positions. As to common walls, from a two-dimensional representation of a layout, the system ensures that the correct number of parts is calculated.

The modelling system **116** bases its determinations on the input user requirements and on information in the product attribute database. It also uses a model of the inter-relationships between the various components. An example of such a model is shown in the tables appearing at the end of this specification.

In an alternate embodiment of the order generation system **115**, as shown in **FIGURE 3**, the functions of the project specifier are incorporated into the modelling tool **116** and there is tight coupling of the modelling tool to a CAD program. In this embodiment of the order generation system **115**, there are two integrated

interfaces to the modelling tool **116**, namely a custom user interface **124** and a custom design interface **126**.

System Operation

The operation of the order generation system **114**, particularly the custom user interface **118**, on computer system **100** is now described with reference to FIGURES 1-15. The custom user interface **124** of the alternative embodiment **115** shown in FIGURE 3 operates in the same manner.

When the order generation system **114** begins running on computer system **100**, the user is presented with a start screen on the display **110** of computer system **100** (at **P100** in FIGURE 4). The start screen presents the user with various user selectable options. The options are presented as demarcated text areas or as icons on the screen depicted on the display **110** of the computer system **100**. Each presented option can be selected with the pointer device **104** or using one or more keys on the keyboard **102**. An option is selected in a known manner such as by clicking the pointer device **104** on the area of the screen on which the option is displayed.

When an option is selected, the custom user interface **118**, running on computer system **100**, determines which option has been selected and then

either processes the option or effects processing of that option. For example, some options are processed entirely within the user interface **118** itself, whereas others require processing by other components of the system **114**, in particular by the modelling tool **116**.

Generally the custom user interface **118** keeps track of user information at a project level. For each project the custom user interface **118** gets information from the user and then tracks and stores that information as needed. The information is tracked and stored in a manner known in the art such as in a data structure or database which can be accessed as needed. When the user interface **118** requires information regarding product attributes, it obtains that information from the product attribute database **120**. When, as the result of some implicit or explicit user request, the user interface **118** requires some processing to be performed by the modelling tool **116**, the user interface **118** invokes the appropriate functionality of the modelling tool **116** and gives the modelling tool **116** whatever data is needed. For example, if, as will be described below, the user requests, via the user interface **118**, that the modelling tool **116** check the validity of a furniture configuration, then the user interface **118** will pass to the modelling tool **116** the appropriate data

representing the current configuration. Using the data it receives about the configuration from the user interface **118**, along with whatever information it needs from the product attribute database **120**, along with the model of the system, the modelling system will then, as requested, check the configuration of the configuration. The result of the configuration check by the modelling tool **116** is not simply a binary "valid" or "invalid" result, but, when possible, is a valid configuration. Thus, the modelling tool **116** is able to pass back configuration data to the user interface **118**.

From the start screen presented to the user by the user interface **118**, the user is given the option of either loading an existing project (i.e., a project which was previously saved by the order generation system **114**) (at **P102**), or beginning a new project (at **P104**). If the user selects the option to open an existing project, then the order generation system **114**, via the user interface **118**, prompts the user for the name under which that project was saved. If the named project can be found, the order generation system **114** retrieves the project and loads it into the system, otherwise the user is prompted for another project name or to start a new project.

If the user selects the option to create a new project (at **P104**), then the user is prompted (at **P106**) to input the needs of the project on a series of planning guide screens. Based on the user's input into the planning guide screens, the order generation system **114** determines which options to present to the user in subsequent display screens.

For example, the user interface **118** compiles or translates the entered user requirements into criteria which both it and the modelling tool **116** can use. Then, when requesting a list of components which meet the user's needs, the user interface and, when necessary, the modelling tool **116**, can query the requirements to ensure that they are met.

One example of such a use would be if the user's needs included standing privacy and lockable storage space. Then, as described below, when the user requested a list of typical configurations satisfying his needs, those which did not provide standing privacy and lockable storage would be excluded.

The various planning requirements (user needs) for which the user is prompted include, but are not limited to, privacy requirements, storage requirements, conferencing criteria, electrical/computer space and connection requirements, space requirements, budget constraints, lighting requirements and types of use.

As to privacy options, the user is given the option of specifying the privacy requirements in terms of panel heights or in terms of various types of privacy: "seating privacy", "standing privacy", "acoustic privacy" and the like. If the user selects certain types of privacy, the order generation system **114** translates this selection into a panel height selection. In preferred embodiments the user is presented with images such as shown in **FIGURE 5** in order to explain the various privacy options.

Preferably the planning guide consists of a series of forms which are graphically displayed on the screen, each form having a number of options. Once the user selects a particular option, a screen for that option is displayed with questions about the various sub-options. For example, in order to determine the user's storage requirements, the user selects a storage requirements option and is presented with a storage requirements screen. As shown in **FIGURE 6**, this screen includes pictures of various types of storage along with textual descriptions of the items which can be stored in each kind of storage.

In some embodiments the user is also provided with an optional tour through a virtual showroom. This tour would consist of a multimedia (e.g., Quicktime etc.) tour through a showroom demonstrating the various

product lines available and various configurations of those products.

Once the user has completed the planning (at **P106**) or opens an existing project (at **P102**) the order generation system **114** provides the user with various options described below. In general, navigation in the order generation system **114** is non-modal. That is, any display screen can be reached from any other display screen and user selected instructions or operations (at **P108**) are performed (at **P110**), in effect, either by the user interface **118** or by some other part of the order generation system **114** such as the modelling tool **116**. Generally, when a user selects an instruction, the order generation system **114** running on computer system **100** performs that instruction. Preferably the user interface **118** performs as many functions as it can, passing requests to the modelling tool **116** only as needed.

Thus, as shown in **FIGURE 7**, each display screen **127** includes various user selectable icons (**128-174**). Preferably, the icons (**128-174**) are grouped and positioned on the screen **124** according to their type of functionality. For example, icons **128-133** relate to project maintenance (saving and restoring) and printing functions; icons **134** and **136** relate to editing functions; icons **138-160** relate to configuration and

customization functions; icons **162** and **164** relate to image positioning and moving functions; planning guide icon **166** relates to the planning guide functionality (described above) and the home icon **168** returns the user to the start (or home) display screen. The window control icons **170-174** are used to size and position the display screen **126** on the display **110**.

When the user selects (by clicking on it with the pointer device **104**) the new project icon **128**, then the user is prompted for the name of the new project and a new project is created.

When the user selects the save project icon **130**, the order generation system **114** saves the current project to a storage device connected to the computer system **100**. The user has the option of changing the name of the project when it is saved.

When the user selects the open project icon **132**, the user is prompted for the name of the project to be opened. If the project of that name is found then it is opened and replaces the current project in the order generation system **114**.

When the user selects the print icon **133**, then the user interface **118** prints the current project.

When the user selects the delete icon **134**, then order generation system **114** deletes the current

selection (on the display). The undo icon **136** is used to undo previous deletions.

The configuration icons **138-148** are now described in greater detail.

By selecting the new typical icon **142**, the user is able to select a typical workstation configuration which satisfies the user's requirements input in the planning stage (at **P106**).

When the user selects the new typical icon **142** a graphical depiction of various typical workstation configurations **180** is displayed on the screen. Each of these displayed typical configurations should satisfy some of the user's requirements, at least with regard to privacy, work area and electrical connectivity. Price and space requirements cannot always be satisfied until a complete clustered configuration is determined.

The user can select one of the displayed typical workstation configurations by clicking on it with the pointer device **104**. The selected typical configuration is highlighted and displayed on the screen (at **182**).

The system is pre-configured with a number of so-called typical configurations, and preferably the typicals displayed on the typical screen are those which satisfy the customer's criteria entered at the customer needs screen (reached by selecting the planning guide icon **166**).

Once the user has selected the typical configuration that is to be used, the user can then double click with the pointer device **104** on the depiction of that typical in order to view it and operate on it. At that time the order generation system **114** displays a three-dimensional view of the selected typical on the screen on display **110** (FIGURE 8). Preferably the selected typical furniture configuration is displayed with the appropriate colors and textures.

With reference to FIGURE 8, the user can rotate and move the selected depicted typical workstation using the zoom icon **162** and the move icon **164**, respectively. The depiction of the workstation can also be moved and rotated using the pointer device positioned on the object and then moved around the screen area. In this way the user can view the workstation from various angles and positions.

Preferably the image is displayed in a selected color and with a selected texture, that is, in the color and texture of the actual product. Selection of color and texture will be described below.

At any time, the typical configuration displayed on the screen can be modified by the user. This modification can be in the form of adding or removing

components, changing the shape, size or color of a component or changing the properties of a component.

While viewing a configuration, the user can select product options. In order to pick product options, the user points and clicks the pointer device on the select material icon **148** on the screen **126**. This causes the computer **100** to display the various materials screen on the display **110**.

The properties screen allows the user to specify a workstation at a detailed level. Every attribute of every part in the workstation can be selected to create a customer's configuration which is then displayed on the screen. The system only allows a user to select valid attributes for each particular component. In that way each displayed configuration is consistent and valid as to its attributes.

In order for the user to resize or reshape components, as shown in FIGURE 9, the user selects the component **182** to be changed using the pointing device **104**. When this is done, the selected component becomes highlighted on the screen and arrows (**184-192**) are shown to depict the various directions in which the part can be resized. The selected part **182** can also be repositioned at another location.

The order generation system **114** will only allow components to be resized or reshaped to valid shapes.

To ensure this requirement, the user interface **118** checks each resize and reshape operation, while it is ongoing, using the product attribute database **120**. However, components can be moved to temporarily invalid locations. As described below, if a component is moved, the configuration will have to be checked and may have to be changed.

In the example shown in FIGURE 9, after the user has resized the component, the support **189** is too long. When the user selects the configuration option **150**, the graphical user interface **118** invokes the modelling tool **116** which will replace the support **189** with one of the correct length.

The user can apply fabric and finishes to a typical product by selecting the select material icon **146** with the pointer **104**. This enables the user to change all fabric and finish options on each individual component or on all components. When the user selects the select material icon **146**, order generation system **114** presents the user with fabric color and finish options on the screen as shown in FIGURE 10. The order generation system **114** will only allow the user to change fabric or finish to valid (manufacturable components in the product line) options for the current components. In this way, the configuration depicted on the screen is always valid with respect to its fabric

and finish. In order for the user to change a fabric or color, the user selects the appropriate option from those shown on the screen. The fabrics/colors are presented in families (three families in the example in FIGURE 10), so that selecting one color for a particular component will change the other parts of that component to the appropriate color from the family.

If, at any time, the user wants to capture an image of the configuration depicted on the screen, the user can select the snapshot icon **152** which causes the rendered image to be enhanced by sharpening and adding depth. These images can then be printed or cut and pasted into other applications.

The user can add components to the depicted typical by selecting the component icon **140** with the pointer device. This causes the order generation system **114** to present the user with a selection of components which can be added to the configuration (FIGURE 10). The selection includes shelves, panels, storage areas and the like. Generally any component from the product line can be added to a configuration.

Once a particular component is selected, the user positions that component on the typical configuration. The order generation system **114** will allow the user to position the component at an invalid location, since it is assumed that the entire configuration will be

checked, and possibly adjusted, later. Thus, for example, the user is able to put a shelf on a panel that cannot support the shelf. This is acceptable since later the system will be reconfigured to replace the panel with one which can support the shelf. Alternatively, if no supporting panel is available in the product line, the shelf will not be added.

In order to check the validity (that is, if it can be manufactured from the specified product line and is otherwise a valid configuration) of a modified workstation, the user selects the configuration check icon **150** from the screen **126**. This causes the order generation system **114** to invoke the checker module which ensures validity of the depicted configuration. Generally, the modelling tool **116** may indicate that the configuration is not feasible, feasible or it may provide various modifications. For example, it may recognize that one component may be split into two or vice versa. It will insert the appropriate support structure to ensure that the configuration can be built.

Once the modelling tool **116** is done with its processing, it returns control to the user.

Once the user is satisfied with a particular typical configuration for a workspace, the user can generate a cluster of those typicals. In order to do

this the user selects the "cluster" icon **144** from the screen **126**. This causes the order generation system **114** to present the user with various clustering options (**FIGURE 12**). The user can then select one of the displayed clustering options and the order generation system **114** generates the appropriate cluster of the current typical.

In generating a cluster of typicals, the order generation system **114** invokes the modelling tool **116** to ensure that the cluster is feasible. The modelling tool **116** removes redundant structures such as common walls and replaces multiple parts with individual parts if possible. If necessary the modelling tool **116** also checks the typical to ensure that it is a valid configuration.

When done, the modelling tool **116** presents the user with a display of the selected cluster of typicals as shown in **FIGURE 13**.

The user can add other detached items such as chairs to a configuration. To do this, the user selects the seating selection icon **138** from the screen **126**. When this is done the order generation system **114** presents the user with a display of chairs such as shown in **FIGURE 14**. The user can select one of the depicted chairs and that chair will be placed (freestanding) in the current cluster or typical.

Once the current typical and/or cluster configuration is acceptable to the user, its price can be determined using the price icon **156**. Selecting the price icon **156** causes the order generation system **114** to determine the price of the entire configuration and to present it to the user as shown in **FIGURE 15**. As can be seen from the quote depicted in **FIGURE 15**, at this time each component item in the configuration is listed and details about that item are given. This quote is for a valid configuration and can be sent directly to the ordering department.

Alternatively, in some embodiments, when a finalized configuration is determined, the quote may be an estimate requiring checking.

As noted above, the modelling system **116** bases its determinations on the input user requirements and on information in the product attribute database. It also uses a model of the inter-relationships between the various components. An example of such a model is shown in the following tables.

In the relationship maps below, the properties are coded as follows: "L" = load bearing, "N" = Non-load bearing, "A" = Provides Aft Support, and "G" = Supplies Ground (Floor) Support.

Environments			**9000**
Service Parts			9000
Interdependant Systems			9000
Casegood Systems			9000
Hanging Units			**3000**
Hanging Shelves			3000
	premise_shelf	PRM	3000
	places_display_shelf	PLC	3000
	places_media_shelf	PLC	3000
	places_mini_corner_shelf	PLC	3000
	places_mini_end_of_run_shelf	PLC	3000
	places_mini_straight_shelf	PLC	3000
	places_monitor_shelf	PLC	3000
	places_pass_through_shelf	PLC	3000
	places_shelf	PLC	3000
	places_shelf_with_coat_rod	PLC	3000
	[illegible]	[illegible]	3000
	[illegible]	[illegible]	3000
	[illegible]	[illegible]	3000
Hanging Lateral Files			3000
	places_hanging_lateral_file	PLC	3000
	[illegible]	[illegible]	3000
Hanging Storage Units			3000
	premise_overhead_unit	PRM	3000
	places_overhead_unit	PLC	3000
	places_shelf_with_flipper_door	PLC	3000
Attached Units			**4000**
Attached Peds			4000
	premise_attached_pedestal	PRM	4000
	places_attached_fundamental_ped	PLC	4000
	places_attached_pedestal	PLC	4000
	[illegible]	[illegible]	4000
	[illegible]	[illegible]	4000
Attached Lateral Files			4000
	premise_attached_lateral_file	PRM	4000
	places_attached_lateral_file	PLC	4000
Attached Bridges			4000
	premise_bridge	PRM	4000
	places_bridge	PLC	4000
	places_transition_bridge	PLC	4000
Attached Cabinets			4000
Upper Attached Cabinets			4000
	new_views_upper_unit	PLC	4000
	series_950_overfile	PLC	4000
Lower Attached Cabinets			4000
	premise_attached_storage_unit	PRM	4000
	new_views_lower_unit	PLC	4000
	places_credenza_door_unit	PLC	4000
Attached Corner Units			4000
	premise_corner_unit	PRM	4000
	premise_wrap_around_unit	PRM	4000
	places_corner_unit	PLC	4000
Attached Convergent Units			4000
	premise_convergent_unit	PRM	4000
	premise_convergent_wrap_around	PRM	4000
	places_convergent_unit	PLC	4000

			Attached Conference End Units										4000
										premise_conference_end_unit	PRM		4000
			Attached Returns										4000
										premise_return	PRM		4000
										places_return	PLC		4000
										places_transition_return	PLC		4000
			Attached Vertical Storage Units										4000
										premise_vertical_storage_unit	PRM		4000
										places_vertical_storage_unit	PLC		4000
			Attached Casegoods Shelves										4000
										premise_bookcase_shelf	PRM		4000
										premise_storage_unit_shelf	PRM		4000
										places_bookcase_shelf	PLC		4000
										places_storage_unit_shelf	PLC		4000
										places_wardrobe_shelf	PLC		4000
										series_950_bookcase_shelf	PLC		4000
										series_950_cabinet_shelf	PLC		4000
										series_950_overfile_shelf	PLC		4000

Attached Credenzas			4000
	places_attached_credenza	PLC	4000
	series_950_credenza_file	PLC	4000
Mobile Units			**8000**
Mobile Peds			8000
	premise_mobile_pedestal	PRM	8000
	places_mobile_pedestal	PLC	8000
	unigroup_mobile_pedestal	UNI	8000
Mobile Tables			8000
	premise_mobile_conference_end_t	PRM	8000
	premise_mobile_teardrop_table	PRM	8000
	places_mobile_conference_end_ta	PLC	8000
	places_mobile_keyboard_table	PLC	8000
	places_mobile_machine_table	PLC	8000
	places_mobile_round_table	PLC	8000
	places_mobile_teardrop_table	PLC	8000
	unigroup_mobile_keyboard_table	UNI	8000
	unigroup_mobile_machine_table	UNI	8000
Mobile Storage Units			8000
	new_views_mobile_cabinet	PLC	8000
Stationary Units			9000
Stationary Peds			9000
	places_stationary_fundamental_pe	PLC	9000
	places_stationary_pedestal	PLC	9000
	unigroup_stationary_fundamental	UNI	9000
	unigroup_stationary_pedestal	UNI	9000
Stationary Tables			9000
	premise_rectangular_table	PRM	9000
	premise_round_table	PRM	9000
	premise_stationary_conference_en	PRM	9000
	premise_stationary_teardrop_table	PRM	9000
	places_c_leg_table	PLC	9000
	places_oval_table	PLC	9000
	places_racetrack_table	PLC	9000
	places_rectangular_table	PLC	9000
	places_square_table	PLC	9000
	places_stationary_conference_end	PLC	9000
	places_stationary_machine_table	PLC	9000
	places_stationary_round_table	PLC	9000
	places_stationary_teardrop_table	PLC	9000
	places_table_desk	PLC	9000
	unigroup_oval_table	UNI	9000
	unigroup_rectangular_table	UNI	9000
	unigroup_round_table	UNI	9000
	unigroup_square_table	UNI	9000
Stationary Vertical Files			9000
Stationary Lateral Files			9000
	premise_stationary_lateral_file	PRM	9000
	places_stationary_lateral_file	PLC	9000
	series_950_combination_lateral_fil	PLC	9000
	series_950_lateral_file	PLC	9000
Stationary Bookcases			9000
	premise_bookcase	PRM	9000
	places_bookcase	PLC	9000
	series_950_bookcase	PLC	9000
Stationary Desks			9000

											premise_desk	PRM	9000
											places_desk	PLC	9000
				Stationary Credenzas									9000
											premise_credenza	PRM	9000
											places_stationary_credenza	PLC	9000
				Stationary Wardrobes									9000
											places_wardrobe	PLC	9000
											series_950_wardrobe	PLC	9000
				Stationary Cabinets									9000
											premise_stationary_storage_unit	PRM	9000
											new_views_stationary_cabinet	PLC	9000
											new_views_storage_cabinet	PLC	9000
											places_stationary_storage_unit	PLC	9000
											series_950_storage_cabinet	PLC	9000
			Suspended Units										**3000**
				Suspended Peds									3000
											places_suspended_fundamental_p	PLC	3000
											places_suspended_pedestal	PLC	3000

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										places_glazed_oblique_panel	PLC	1000
								Places Solid Panels				1000
									Places Standard Solid Panels			1000
									places_solid_panel	PLC	1000
									[illegible]	UNI	1000
									Places Gabled Solid Panels			1000
									places_gabled_panel	PLC	1000
									Places Oblique Solid Panels			1000
									places_oblique_panel	PLC	1000
									Places Beltline Solid Panels			1000
									places_beltline_panel	PLC	1000
									Places Ported Solid Panels			1000
									places_ported_panel	PLC	1000
				Stacked Verticals								**2000**
					Stack Kits							2000
					Pads							2000
					Extender Screens							2000
					Desking Screens							2000
					Fan Lights							**6000**

		places_fanlight	PLC	6000
	Modesty Panels			**2000**
		places_convergent_modesty_pane	PLC	2000
		places_corner_modesty_panel	PLC	2000
		places_straight_modesty_panel	PLC	2000
	Vertical Accessories			**9000**
		places_blind_kit	PLC	9000
		places_counter_top_end_cover	PLC	9000
		places_electronic_work_surface_e	PLC	9000
		places_muntin_kit	PLC	9000
		places_wainscot_kit	PLC	9000
		unigroup_electronic_work_surfa	UNI	9000
Horizontals				**3000**
	Work Surfaces			3000
	Corner Work Surfaces			3000
	Height Adjustable Corner Work Surfaces			3000
		places_height_adjustable_corner_	PLC	3000
		places_height_adjustable_split_cor	PLC	3000
		unigroup_height_adjustable_corn	UNI	3000
		unigroup_height_adjustable_spl	UNI	3000
	Regular Corner Work Surfaces			3000
		premise_corner_work_surface	PRM	3000
		premise_wrap_around_work_surfa	PRM	3000
		places_corner_work_surface	PLC	3000
		places_wrap_around_work_surface	PLC	3000
		unigroup_corner_work_surfac	UNI	3000
		unigroup_wrap_around_work_surf	UNI	3000
	Electronic Corner Work Surfaces			3000
		places_electronic_corner_work_su	PLC	3000
		unigroup_electronic_corner_work_s	UNI	3000
	Transitional Corner Work Surfaces			3000
		premise_transitional_wrap_around_	PRM	3000
		places_transitional_corner_work_s	PLC	3000
		places_transitional_wrap_around_w	PLC	3000
		unigroup_transitional_corner_wo	UNI	3000
		unigroup_transitional_wrap_around	UNI	3000
	Rectangular Work Surfaces			3000
	Height Adjustable Rectangular Work Surfaces			3000
		places_height_adjustable_rectangu	PLC	3000
		unigroup_height_adjustable_rectan	UNI	3000
	Regular Rectangular Work Surfaces			3000
	Premise Regular Rectangular Work Surfaces			3000
		premise_radiused_rectangular_wo	PRM	3000
		premise_rectangular_work_surface	PRM	3000
		premise_split_rectangular_work_su	PRM	3000
	Places Regular Rectangular Work Surfaces			3000
		places_monitor_work_surface	PLC	3000
		places_radiused_rectangular_work	PLC	3000
		places_rectangular_work_surface	PLC	3000
		places_rectangular_work_surface_	PLC	3000
		places_split_rectangular_work_sur	PLC	3000
		unigroup_radiused_rectangular_wo	UNI	3000
		unigroup_rectangular_work_surface	UNI	3000
		unigroup_rectangular_work_surface	UNI	3000
		unigroup_split_rectangular_work_s	UNI	3000

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		places_conference_end_work_surf	PLC	3000
		[illegible]	UNI	3000
	Single Run Conference Ends			3000
		premise_curved_work_surface	PRM	3000
		premise_teardrop_end_work_surfa	PRM	3000
		places_curved_work_surface	PLC	3000
		places_d_shaped_end_work_surfa	PLC	3000
		places_teardrop_end_work_surfac	PLC	3000
		[illegible]	UNI	3000
		[illegible]	UNI	3000
	Countertops			3000
	Straight Countertops			3000
		premise_rectangular_counter_top	PRM	3000
		places_rectangular_counter_top	PLC	3000
		places_wheelchair_reception_coun	PLC	3000
		[illegible]	UNI	3000
	Corner Countertops			3000
		places_corner_counter_top	PLC	3000
		[illegible]	UNI	3000
	Horizontal Accessories			3000
		premise_keyboard_holders	PRM	3000
		premise_mouse_pad	PRM	3000
		premise_palm_rest	PRM	3000
		places_carousel	PLC	3000
		places_corner_canopy	PLC	3000
		places_electronic_transition_cover	PLC	3000
		places_keyboard_holders	PLC	3000
		places_make_a_corner	PLC	3000
		places_mouse_pad	PLC	3000
		places_palm_rest	PLC	3000
		[illegible]	UNI	3000
		[illegible]	UNI	3000
		[illegible]	UNI	3000
		[illegible]	UNI	3000
		[illegible]	UNI	3000
	Table Tops			3000
	Vertical Supports			**7000**
	Covers			7000
	Finish Covers			7000
		premise_variable_height_cover	PRM	7000
		places_canopy_finish_post	PLC	7000
		places_electrical_end_cap	PLC	7000
		places_end_of_run_post	PLC	7000
		places_finish_post	PLC	7000
		places_variable_end_of_run_post	PLC	7000
		[illegible]	UNI	7000
		[illegible]	UNI	7000
		[illegible]	UNI	7000
		[illegible]	UNI	7000
	Electrical Covers			7000
		new_views_base_cover_kit	PLC	7000
		places_180_connector_cover	PLC	7000

36/1

											places_90_connector_cover	PLC	7000
											[illegible]	[illegible]	7000
											[illegible]	[illegible]	7000
				Connectors									7000
					T-Mount Kit								7000
											new_views_t_mount_bracket	PLC	7000
					Standard Connectors								7000
											premise_connector	PRM	7000
											places_hinge	PLC	7000
											[illegible]	[illegible]	7000
				Modesty Panel Supports									7000
											places_modesty_to_cabinet_brack	PLC	7000
											places_modesty_to_panel_bracket	PLC	7000
				Posts									7000
					Upper Posts								7000
					Lower Posts								7000
				Architectural Connections									7000

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		[illegible]	UNI	5000
				5000
	Out-Feeds			5000
		premise_base_igr_receptacle	PRM	5000
		premise_base_receptacle	PRM	5000
		premise_panel_communications_p	PRM	5000
		premise_panel_power_port_kit	PRM	5000
		places_base_igr_receptacle	PLC	5000
		places_base_igr_surge_protecter_	PLC	5000
		places_base_receptacle	PLC	5000
		places_smart_work_surface_powe	PLC	5000
		places_switching_system_kit	PLC	5000
		places_switching_system_power_s	PLC	5000
		places_switching_system_receptac	PLC	5000
		places_switching_system_wall_swi	PLC	5000
		places_work_surface_duplex_rece	PLC	5000
		places_work_surface_power_modu	PLC	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
	Power and Data Routers			5000
	Power and Data Channels			5000
		premise_vertical_wire_manager	PRM	5000
		places_cable_management_post	PLC	5000
		places_horizontal_wire_manager_3	PLC	5000
		places_horizontal_wire_manager_4	PLC	5000
		places_variable_height_cable_mar	PLC	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
	Power and Data Connectors			5000
		premise_extended_power_connect	PRM	5000
		premise_flexible_power_connector	PRM	5000
		premise_straight_span_power_con	PRM	5000
		places_base_to_beltline_power_co	PLC	5000
		places_beltline_to_beltline_power_	PLC	5000
		places_extended_power_connecto	PLC	5000
		places_flexible_power_connector	PLC	5000
		places_straight_power_connector	PLC	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
		[illegible]	UNI	5000
	Cable Management			5000
		premise_grommet	PRM	5000
		premise_wire_management_loop	PRM	5000
		places_cable_management_beltlin	PLC	5000
		places_cable_management_ported	PLC	5000
		places_cable_management_top_ca	PLC	5000
		places_grommet	PLC	5000
		places_wire_basket	PLC	5000
		places_wire_management_loop	PLC	5000
		places_wire_management_module	PLC	5000

											places_wire_manager	PLC	5000
											places_work_surface_power_modu	PLC	5000
											[illegible]	UNI	5000
											[illegible]	UNI	5000
											[illegible]	UNI	5000
		Lighting											**6000**
			Horizontally Mounted Lighting										6000
											premise_task_light	PRM	6000
											premise_vertical_storage_task_ligh	PRM	6000
											places_canopy_light	PLC	6000
											places_counter_top_task_light	PLC	6000
											places_freestanding_pivot_head_ta	PLC	6000
											places_task_light	PLC	6000
											[illegible]	UNI	6000
											[illegible]	UNI	6000
											[illegible]	UNI	6000
			Vertically Mounted Lighting										6000
											places_grid_hung_pivot_head_task	PLC	6000

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39/1

[illegible]	UNI	9000
[illegible]	UNI	9000
Horizontal Workflows		9000
premise_pedestal_pencil_tray	PRM	9000
paper_management_freestanding_	PLC	9000
paper_management_suspended_h	PLC	9000
paper_management_trays	PLC	9000
paper_management_under_shelf_	PLC	9000
places_freestanding_grid_mailbox	PLC	9000
places_fundamental_pedestal_tray	PLC	9000
places_grid_mailbox	PLC	9000
places_grid_reference_tray	PLC	9000
tri_mode_divider	PLC	9000
tri_mode_hanger_clip	PLC	9000
tri_mode_horizontal_shelves	PLC	9000
tri_mode_horizontal_unit	PLC	9000
Diagonal Workflows		9000
paper_management_freestanding_	PLC	9000
paper_management_suspended_d	PLC	9000

											tri_mode_diagonal_unit	PLC	9000
			Workflow Bins										9000
											places_grid_diskette_bin	PLC	9000
											places_grid_storage_bin	PLC	9000
Services													9000

Relationship Maps (part 1 of 34)

Class Structure	Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Environments				N/A			1	"LWC: Environments" (Overridden at lower class levels)
Service Parts				A3			???	
Interdependant Systems				N/A			???	
Casegood Systems				B5			???	
Hanging Units				C6	1	"Hang Stuff" AND "HU"	1	"LW Hang Stuff"
Hanging Shelves				D7	Inh		Inh	
	premise_shelf	PRM			Inh		Inh	
	places_display_shelf	PLC			Inh		Inh	
	places_media_shelf	PLC			Inh		Inh	
	places_mini_corner_shelf	PLC			Inh		Inh	
	places_mini_end_of_run_shelf	PLC			Inh		Inh	
	places_mini_straight_shelf	PLC			Inh		Inh	
	places_monitor_shelf	PLC			Inh		Inh	
	places_pass_through_shelf	PLC			1	Requires an open panel	1	Override x/z_pos such that panel bisects shelf
	places_shelf	PLC			Inh		Inh	
	places_shelf_with_coat_rod	PLC			Inh		Inh	
Hanging Lateral Files				D7	Inh		Inh	
	places_hanging_lateral_file	PLC			Inh		Inh	
Hanging Storage Units				D7	Inh		Inh	
	premise_overhead_unit	PRM			Inh		Inh	
	places_overhead_unit	PLC			Inh		Inh	
	places_shelf_with_flipper_door	PLC			Inh		Inh	
Attached Units				C6	1	If attaching to a member of X_Credenzas or X_Desks, must attach to the "open" front		

Relationship Maps (part 2 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Attached Peds		AFG	D25	1	"AP"	1	"Set AP Depth" and "Place Storage"
premise_attached_pedestal	PRM	AFG	#REF!	1	"AP prm-ap"		
places_attached_fundamental_pedestal	PLC			Inh		Inh	
places_attached_pedestal	PLC			Inh		Inh	
Attached Lateral Files		AFG	D25	1	"ALF"	1	"Place Storage"
premise_attached_lateral_file	PRM			1	"ALF prm-alf"	Inh	
places_attached_lateral_file	PLC			Inh		Inh	
Attached Bridges			D25	1	"AB"	1	"Center on Floor" AND "Attach Bridge/Return"
premise_bridge	PRM			Inh		Inh	
places_bridge	PLC			Inh		Inh	
places_transition_bridge	PLC			Inh		Inh	
Attached Cabinets			D25				
Upper Attached Cabinets			E37				
new_views_upper_unit	PLC			1	"UAC nv-uu"	???	
series_950_overfile	PLC			???	**Must sit on top of ???**	???	

SUBSTITUTE SHEET (RULE 26)

Relationship Maps (part 3 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Lower Attached Cabinets			E37	1	"LAC"	???	
premise_attached_storage_unit	PRM			1	"LAC prm-asu"	???	
new_views_lower_unit	PLC			1	"LAC nv-lu"	1	"Center on Floor" and "Set LWC Position Attached Lateral File And Storage Unit"
places_credenza_door_unit	PLC			???		???	
Attached Corner Units			D25	1	Both sides must attach to a member of Attached_Returns/ Bridges/ Credenzas/ Desks	1	"Center on Floor"
premise_corner_unit	PRM			Inh		Inh	
premise_wrap_around_unit	PRM			Inh		Inh	
places_corner_unit	PLC			Inh		Inh	
Attached Convergent Units			D25	1	"AConvU"	1	"Center on Floor"
premise_convergent_unit	PRM		49	Inh		Inh	
premise_convergent_wrap_around_d_unit	PRM			Inh		Inh	
places_convergent_unit	PLC			Inh		Inh	
Attached Conference End Units			D25			1	"Center on Floor"
premise_conference_end_unit	PRM			Inh		Inh	
Attached Returns			D25	1	"ARet"	1	"Center on Floor"
premise_return	PRM			Inh		Inh	
places_return	PLC			1	If 30" panel used as return, WS must use brackets, not cantilevers	Inh	
places_transition_return	PLC			1	If 30" panel used as return, WS must use brackets, not cantilevers	Inh	

Relationship Maps (part 4 of 34)

Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	Constraint C#	Constraint Relationships	Light Weight L#	Light Weight Relationships
Attached Vertical Storage Units				D25	1	"AVSU"	1	"Center on Floor"
	premise_vertical_storage_unit	PRM			Inh		Inh	
	places_vertical_storage_unit	PLC			Inh		Inh	
Attached Casegoods Shelves				D25			1	LWC: ACS
	premise_bookcase_shelf	PRM			n/a	ACCESSORY	n/a	ACCESSORY
	premise_storage_unit_shelf	PRM			n/a	ACCESSORY	n/a	ACCESSORY
	places_bookcase_shelf	PLC			n/a	ACCESSORY	n/a	ACCESSORY
	places_storage_unit_shelf	PLC			n/a	ACCESSORY	n/a	ACCESSORY
	places_wardrobe_shelf	PLC			n/a	ACCESSORY	n/a	ACCESSORY
	series_950_bookcase_shelf	PLC			n/a	ACCESSORY	n/a	ACCESSORY
	series_950_cabinet_shelf	PLC			n/a	ACCESSORY	n/a	ACCESSORY
	series_950_overfile_shelf	PLC			n/a	ACCESSORY	n/a	ACCESSORY
Attached Credenzas				D25	1	Must attach to a member of X_Corners or X_Desks	1	"Center on Floor"
	places_attached_credenza	PLC			Inh		Inh	
	series_950_credenza_file	PLC				must sit under worksurface, flush to front - exactly the same as Attached Drawer Pedestal (has no top)	Inh	

Relationship Maps (part 5 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Mobile Units			C6	1	Must sit on floor	1	"Center on Floor"
Mobile Peds			D74				
premise_mobile_pedestal	PRM			Inh		Inh	
places_mobile_pedestal	PLC			Inh		Inh	
Mobile Tables			D74				
premise_mobile_conference_end_table	PRM			Inh		Inh	
premise_mobile_teardrop_table	PRM			Inh		Inh	
places_mobile_conference_end_table	PLC			Inh		Inh	
places_mobile_keyboard_table	PLC			Inh		Inh	
places_mobile_machine_table	PLC			Inh		Inh	
places_mobile_round_table	PLC			Inh		Inh	
places_mobile_teardrop_table	PLC			Inh		Inh	
Mobile Storage Units			D74				
new_views_mobile_cabinet	PLC			Inh		Inh	

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Relationship Maps (part 6 of 34)

Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	Constraint Relationships C#	Constraint Relationships	Light Weight Relationships L#	Light Weight Relationships
	Stationary Units			C6	1	Must sit on floor	1	"Center on Floor"
	Stationary Peds			D88				
	places_stationary_fundamental_pedestal	PLC			???		lnh	
	places_stationary_pedestal	PLC			???		lnh	
	Stationary Tables			D88				
	premise_rectangular_table	PRM			???		lnh	
	premise_round_table	PRM			???		lnh	
	premise_stationary_conference_end_table	PRM			???		lnh	
	premise_stationary_teardrop_table	PRM			???		lnh	

Relationship Maps (part 7 of 34)

Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
	places_c_leg_table	PLC			???		Inh	
	places_oval_table	PLC			???		Inh	
	places_racetrack_table	PLC			???		Inh	
	places_rectangular_table	PLC			???		Inh	
	places_square_table	PLC			???		Inh	
	places_stationary_conference_end_table	PLC			???		Inh	
	places_stationary_machine_table	PLC			???		Inh	
	places_stationary_round_table	PLC			???		Inh	

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Relationship Maps (part 8 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	Constraint C#	Constraint Relationships	Light Weight L#	Light Weight Relationships
places_stationary_teardrop_table	PLC			???		Inh	
places_table_desk	PLC			???		Inh	
Stationary Vertical Files			D88				
Stationary Lateral Files			D88				
premise_stationary_lateral_file	PRM			???		Inh	
places_stationary_lateral_file	PLC			???		Inh	
series_950_combination_lateral_file	PLC				**stands there - is configurable (4 heights) - work like drawer pedestals**		
series_950_lateral_file	PLC				**stands there - 2/3/4/5 high - settable via properties**		
Stationary Bookcases			D88				
premise_bookcase	PRM			Inh		Inh	
places_bookcase	PLC			Inh		Inh	
series_950_bookcase	PLC			Inh	2/3/4/5 high - settable via properties	Inh	
Stationary Desks			D88				
premise_desk	PRM			???		Inh	
places_desk	PLC			???		Inh	
Stationary Credenzas			D88				
premise_credenza	PRM			???		Inh	
places_stationary_credenza	PLC			???		Inh	
Stationary Wardrobes			D88				
places_wardrobe	PLC			???		Inh	

Relationship Maps (part 9 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
series_950_wardrobe	PLC				**Stands there, only 1 size (uses series_950_storage_cabinet metafile)**	Inh	
Stationary Cabinets			D88				
premise_stationary_storage_unit	PRM			???		Inh	
new_views_stationary_cabinet	PLC			Inh		Inh	
new_views_storage_cabinet	PLC			Inh		Inh	
places_stationary_storage_unit	PLC			Inh		Inh	
series_950_storage_cabinet	PLC				**Stands there - 4 or 5 high - no shelves or 3 shelves**		
Suspended Units			C6				
Suspended Peds			D132	1	Mounts under WS, Return, Desk, or Credenza - but not a Bridge	1	"Place Storage" AND "LWC: Set SP Depth/Pos"
places_suspended_fundamental_pedestal	PLC			Inh		Inh	
places_suspended_pedestal	PLC			Inh		Inh	
Suspended Drawers			D132	1	Must Mount to Front Edge of Worksurface		
premise_pencil_drawer	PRM			Inh		???	
places_pencil_drawer	PLC			Inh		???	
places_steel_pencil_drawer	PLC			Inh		???	
places_wood_pencil_drawer	PLC			Inh		???	

Relationship Maps (part 10 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Casegood Accessories			C6				
premise_lateral_file_counterweight	PRM			Dep	ACCESSORY	n/a	ACCESSORY (Note: 1included with 2-highs)
premise_vertical_storage_unit_template	PRM			Dep	ACCESSORY	n/a	ACCESSORY
places_flipper_door	PLC			???		???	
places_lateral_file_counterweight	PRM			Dep	ACCESSORY	n/a	ACCESSORY (Note: 1included with 2-highs)
places_tug_a_ped	PLC			Dep	ACCESSORY	n/a	ACCESSORY
places_vertical_storage_unit_retrofit_kit	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_vertical_storage_unit_template	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_bookcase_top	PLC				Must be the same size as target bookcase		
series_950_counterweight	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_credenza_double_top	PLC				contiguous top for 2 bins of same height and width		
series_950_credenza_single_top	PLC				used when a CF is in the open		
series_950_lock_bar	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_storage_coat_rod	PLC			n/a	ACCESSORY		
series_950_storage_media_bar	PLC			n/a	ACCESSORY		
Wall Systems			B5				
Verticals			C156				
Vertical Bases			D157				
Mobile Bases			E158				
Sliders			F159				
Stationary Bases			E158				

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Relationship Maps (part 11 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Beams			F161				
Privacy Screens			F161				
Scaffolds			F161				
Panels			F161	1	Panels Require Support (Physics Constraint)	1	"LWC: Panels"
Premise_Panels			G165	1	"PRM Panels"		
Premise_Doors			H166	1	"PRM Doors"		
premise_door	PRM			Inh		Inh	
Premise Glazed Panels			H166				
premise_glazed_panel	PRM			Inh		Inh	
Premise Solid Panels			H166				
premise_solid_panel				1	"PSP prm-sp"	Inh	
Places Panels			G165	1	"PLC Panels"		
Places Doors			H173	1	Door-Swing must match the direction of the return panel and the hinged side of the door should be towards the supporting panels		
places_door	PLC			1	Must have a return panel >=24" deep that's <=24" unloaded standard panel away from hinge	Inh	

Relationship Maps (part 12 of 34)

Class Structure / Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
places_double_door	PLC			1	Must have a return panel at each hinge - i.e. 0" away	Inh	
Places Framed Panels			H173	1	Framed Panels Have Restrictions (Physics Constraint)		
places_open_panel	PLC			Inh		Inh	
Glazed Panels			H173				
Standard Glazed Panels			I179				
places_glazed_panel	PLC			Inh		Inh	
Gabled Glazed Panels			I179				
places_glazed_gabled_panel	PLC			Inh		Inh	
Oblique Glazed Panels			I179				
places_glazed_oblique_panel	PLC			Inh		Inh	
Solid Panels			H173				
Standard Solid Panels			I186				
places_solid_panel	PLC			Inh		Inh	
Gabled Solid Panels			I186				
places_gabled_panel	PLC			Inh		Inh	
Oblique Solid Panels			I186				
places_oblique_panel	PLC			Inh		Inh	
Beltline Solid Panels			I186	1	If >10' run with WS, requires corner braces at ends		

Relationship Maps (part 13 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_beltline_panel	PLC			Inh		Inh	
Ported Solid Panels			I186				
places_ported_panel	PLC			Inh		Inh	
Stacked Verticals			D157				
Stack Kits			E197				
Pads			E197				
Extender Screens			E197				
Desking Screens			E197				
Fan Lights			E197	1	"FL"		
places_fanlight	PLC			Inh			
Modesty Panels			D157				
places_convergent_modesty_panel	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I
places_corner_modesty_panel	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I
places_straight_modesty_panel	PLC						

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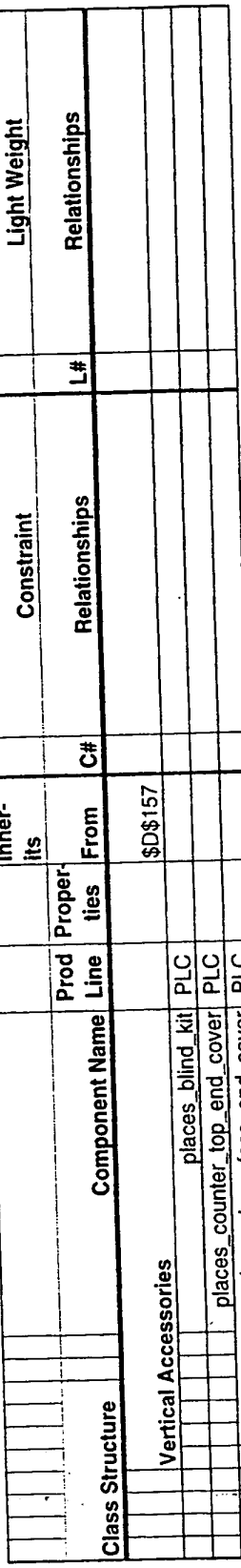
Relationship Maps (part 14 of 34)



Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
Vertical Accessories				D157				
	places_blind_kit	PLC						
	places_counter_top_end_cover	PLC						
	places_electronic_work_surface_end_cover	PLC						

Relationship Maps (part 15 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_muntin_kit	PLC			1	Must attach to Places Glazed_Panels, matching its size		
places_wainscot_kit	PLC			1	Must attach to Places Glazed_Panels, matching its size		
Horizontals			C156				
Work Surfaces		L	D214	1	"Hang Stuff" AND "Work Surfaces"	1	"Hang Stuff"
Corner Work Surfaces			E215	1	Require "3-corner" support		
Height Adjustable Corner Work Surfaces			F216				
places_height_adjustable_corner_work_surface	PLC						
places_height_adjustable_split_corner_work_surface	PLC						
Regular Corner Work Surfaces			F216				
premise_corner_work_surface	PRM			1	"RCornWS prm-cws"		
premise_wrap_around_work_surface	PRM			1	"RCornWS prm-waws"		
places_corner_work_surface	PLC						
places_wrap_around_work_surface	PLC						
Electronic Corner Work Surfaces			F216	1	If 2 adjacent electronic WS are separated by 2" gap (i.e. they span a 3-way junction) they need 1 places_electronic_work_surface_transition_cover between them		
places_electronic_corner_work_surface	PLC						

Relationship Maps (part 16 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Transitional Corner Work Surfaces			F216				
premise_transitional_wrap_around_work_surface	PRM			1	"TCWS prm-twaws"		
places_transitional_corner_work_surface	PLC						
places_transitional_wrap_around_work_surface	PLC						
Rectangular Work Surfaces			E215				
Height Adjustable Rectangular Work Surfaces			F231				
places_height_adjustable_rectangular_work_surface	PLC						
Regular Rectangular Work Surfaces			F231	1	"RegRectWS"		
Premise_Regular_Rectangular_Work_Surfaces			G234	1	Premise Work Surfaces must have floor support every 5'		
premise_radiused_rectangular_work_surface	PRM			1	"PRRWS prm-rrws"		
premise_rectangular_work_surface	PRM			1	"PRRWS prm-rws"		
premise_split_rectangular_work_surface	PRM			1	"PRRWS prm-srws"		

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Relationship Maps (part 17 of 34)

Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
	Places_Regular_Rectangular_Work_Surfaces			G234				
	places_monitor_work_surface	PLC						
	places_radiused_rectangular_work_surface	PLC						
	places_rectangular_work_surface	PLC						
	places_rectangular_work_surface_top	PLC						
	places_split_rectangular_work_surface	PLC						

Relationship Maps (part 18 of 34)

Class Structure Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Electronic Rectangular Work Surfaces			F231	1	If 2 adjacent electronic WS are separated by 2" gap (i.e. they span a 3-way junction) they need 1 places_electronic_work_surface_transition_cover between them		
places_electronic_rectangular_work_surface	PLC						
Transitional Rectangular Work Surfaces			F231				
premise_transitional_rectangular_work_surface	PRM			1	"TRWS prm-trws"		
places_transitional_rectangular_work_surface	PLC						
Convergent Work Surfaces			E215	1	If Places, may mount to a panel up to six inches narrower than the convergent (panel run must be => than the width of the convergent)		
Regular Convergent Work Surfaces			F250				
premise_convergent_work_surface	PRM			1	"RConvWS prm-cws"		
places_convergent_work_surface	PLC			1	"RConvWS plc-cws"		
Shaped Convergent Work Surfaces			F250				
premise_shaped_wrap_around_work_surface	PRM			1	"SCWS prm-swaws"		
places_shaped_wrap_around_work_surface	PLC						
Conference Ends			E215				
Regular Conference Ends			F257	1	Attaches to 2 worksurfaces with panel between		
premise_conference_end_work_surface	PRM			1	"RCE prm-cews"		

Relationship Maps (part 19 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_conference_end_work_surface	PLC						
Single Run Conference Ends			F257				
premise_curved_work_surface	PRM			1	"SRCE prm-cws"		
premise_teardrop_end_work_surface	PRM			1	"SRCE prm-tews"		
places_curved_work_surface	PLC						
places_d_shaped_end_work_surface	PLC						
places_teardrop_end_work_surface	PLC						
Countertops			D214				
Straight Countertops			E267	1	Mounts on top of in-line panel run of uniform (<=53") height longer than the width of the counter top		
premise_rectangular_counter_top	PRM						
places_rectangular_counter_top	PLC						
places_wheelchair_reception_counter_top	PLC			1	Must be installed over two solid panels: 1) 48" counter over two 24" wide panels, 2) 60" counter over two 36" wide panels		

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Relationship Maps (part 20 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Corner Countertops			E267				
places_corner_counter_top	PLC			1	"CC plc-cct"		
Horizontal Accessories			D214				
premise_keyboard_holders	PRM						
premise_mouse_pad	PRM						

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Relationship Maps (part 21 of 34)

Class Structure / Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
premise_palm_rest	PRM						
places_carousel	PLC						
places_corner_canopy	PLC			1	"HA plc-cc"		
places_electronic_transition_cover	PLC						
places_keyboard_holders	PLC						
places_make_a_corner	PLC			1	Requires 2 perpendicular panels - comes in at 45 degrees	1	Find corner closest to click_loc, y_rot = avg of 2 corner pieces rotations, x/z_pos so as to position make_a_corner between them
places_mouse_pad	PLC						
places_palm_rest	PLC						
Table Tops			D214				
Vertical Supports			C156				
Covers			D286				
Finish Covers			E287				
premise_variable_height_cover	PRM						
places_canopy_finish_post	PLC						
places_electrical_end_cap	PLC						
places_end_of_run_post	PLC			1	Height must match panel height		
places_finish_post	PLC			1	**Height/orientation should be appropriate ??**		
places_variable_end_of_run_post	PLC			1	Height must match difference in panel heights		
Electrical Covers			E287				

Relationship Maps (part 22 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
new_views_base_cover_kit	PLC			???		???	
places_180_connector_cover	PLC						
places_90_connector_cover	PLC						
Connectors			D286	1	Must sit on floor		
T-Mount Kit			E299	1	Cannot position the T-mount within .82" from end of panel		
new_views_t_mount_bracket	PLC			inh		???	
Standard Connectors			E299				
premise_connector	PRM			1	Must be as tall as the tallest panel being joined		
places_hinge	PLC						
Modesty Panel Supports			D286				
places_modesty_to_cabinet_bracket	PLC						
places_modesty_to_panel_bracket	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I

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Relationship Maps (part 23 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Posts			D286				
Upper Posts			E308				
Lower Posts			E308				
Architectural Connections			D286				
Horizontal Supports			C156				
Table Bases			D312	1	Must sit on floor		

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Relationship Maps (part 24 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Brackets			D312				
Panel Attached Brackets			E314				
premise_pedestal_to_panel_bracket	PRM	AF (when used in pairs)					
premise_work_surface_cantilever	PRM	AF		1	Unable to support 30" deep work surface with only cantilevers	n/a	
premise_work_surface_corner_bracket	PRM	AF		1	The long side of the bracket must align to a Panel (i.e. bracket must "clip" to a panel)	n/a	
places_included_work_surface_cantilever	PLC			n/a		n/a	
places_work_surface_cantilever	PLC						
places_work_surface_corner_bracket	PLC						
places_work_surface_panel_mount	PLC						
places_work_surface_side_mount	PLC						
places_work_surface_slope_mount	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I
series_950_credenza_file_work_surface_support	PLC				**required when cantiliever in the way - use in place: provides aft support, credenza provides fore support**		

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Relationship Maps (part 25 of 34)

Class Structure / Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
Non-Panel Attached Brackets			E314				
premise_work_surface_drop_mount	PRM						
premise_work_surface_flush_mount	PRM						
new_views_cabinet_to_work_surface_bracket	PLC			Dep	*(brought in when NV Upper Cabinet touches a WS)*	n/a	
places_work_surface_drop_mount	PLC						
places_work_surface_flush_mount	PLC						
Legs			D312				
premise_work_surface_support_leg	PRM						
places_work_surface_support_leg	PLC						
Worksurface Support Panels		AF, Acts as Return	D312	1	Must sit on floor		
premise_work_surface_support_panel	PRM						
places_conference_end_support	PLC						
places_work_surface_end_full_support_panel	PLC						
places_work_surface_end_half_support_panel	PLC						
places_work_surface_support_panel	PLC						

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Relationship Maps (part 26 of 34)

Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
	Height Adjustment Kits			D312				
	premise_lateral_file_height_adjustment_kit	PRM						
	premise_pedestal_height_adjustment_kit	PRM						
	premise_storage_unit_height_adjustment_kit	PRM						
	Adjustable Supports			D312				
	places_height_adjustable_corner_mechanism	PLC						

SUBSTITUTE SHEET (RULE 26)

Relationship Maps (part 27 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_height_adjustable_rectangular_mechanism	PLC						
places_height_adjustable_split_corner_mechanism	PLC						
Seating			A3	1	Must sit on floor		
Auditorium Seating			B349				
Adjustable Seating			B349				
accolade_caster_base_chair	PLC						
accolade_caster_base_stool	PLC						
improv_caster_base_chair	PLC						
improv_he_caster_base_chair	PLC						
Stackable Seating			B349				
improv_leg_base_stacking_chair	PLC						
Non-Adjustable Seating			B349				
accolade_sled_base_chair	PLC						
improv_leg_base_stool	PLC						
improv_sled_base_chair	PLC						
Lounge Seating			B349				
Benches			C362				
Single Lounge Seating			C362				
Multiple Lounge Seating			C362				
Power and Data			A3				

SUBSTITUTE SHEET (RULE 26)

Relationship Maps (part 28 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
Power and Data Providers			B366				
In-Feeds			C367				
premise_base_feed_module	PRM						
premise_top_feed_module	PRM						
places_base_feed_module	PLC						
places_top_feed_module	PLC						
Out-Feeds			C367				
premise_base_igr_receptacle	PRM						
premise_base_receptacle	PRM			1	Require 1 of the 4 receptacle ports on each panel	1	Snaps to receptacle port matching front/back and left/right, orientation same if front, 180 out if back
premise_panel_communications_port_kit	PRM						
premise_panel_power_port_kit	PRM			1	"OF prm-pppk"		
places_base_igr_receptacle	PLC			1	requiresContainer(Raceway_Outlet), collocated and available	1	Snaps to Raceway_Outlet matching front/back and left/right, orientation same if front, 180 out if back
places_base_igr_surge_protecter_receptacle	PLC						
places_base_receptacle	PLC						
places_smart_work_surface_power_module	PLC						
places_switching_system_kit	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I
places_switching_system_power_supply	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I

Relationship Maps (part 29 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_switching_system_receptacle	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I
places_switching_system_wall_switch	PLC			n/a	NOT IN PHASE I	n/a	NOT IN PHASE I
places_work_surface_duplex_receptacle	PLC			1	Requires a WS to sit on	1	Goes on top of WS at click_x, click_z
places_work_surface_power_module	PLC						
Power and Data Routers			B366				
Power and Data Channels			C388				
premise_vertical_wire_manager	PRM			n/a	ACCESSORY	n/a	ACCESSORY
places_cable_management_post	PLC						
places_horizontal_wire_manager_33in	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_horizontal_wire_manager_40in	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_variable_height_cable_management_post	PLC						
Power and Data Connectors			C388	1	Consume 1 left- and 1 right-hand power site		
premise_extended_power_connector	PRM			1	*(used to span non-powered panels)*		
premise_flexible_power_connector	PRM			1	Consume 1 left- and 1 right-hand power site		
premise_straight_span_power_connector	PRM			1			
places_base_to_beltline_power_connector	PLC						
places_beltline_to_beltline_power_connector	PLC						
places_extended_power_connector	PLC						
places_flexible_power_connector	PLC						
places_straight_power_connector	PLC						
Cable Management			B366				
premise_grommet	PRM						
premise_wire_management_loop	PRM			n/a	ACCESSORY	n/a	ACCESSORY

Relationship Maps (part 30 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_cable_management_beltline_cover_plate	PLC						
places_cable_management_ported_cover_plate	PLC						
places_cable_management_top_cap	PLC						
places_grommet	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_wire_basket	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_wire_management_loop	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_wire_management_module	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_wire_manager	PLC			1	Mounts underneath WS	1	Sits underneath WS at click_x, click_z
places_work_surface_power_module_storage	PLC						
Lighting			B366				
Horizontally Mounted Lighting			C416	1	Requires receptacle within 72 linear inches from the left or right back corner (on the supporting or either adjacent panel)		
premise_task_light	PRM			1	"HML prm-tl"		
premise_vertical_storage_task_light_bracket	PRM			???			
places_canopy_light	PLC			1	Attaches below places_canopy		
places_counter_top_task_light	PLC			1	"HML plc-cttl"		
places_freestanding_pivot_head_task_light	PLC			1	Requires flat surface to sit on		

SUBSTITUTE SHEET (RULE 26)

Relationship Maps (part 31 of 34)

Class Structure / Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
places_task_light	PLC			1	"HML plc-tl"		
Vertically Mounted Lighting			C416				
places_grid_hung_pivot_head_task_light	PLC			n/a	ACCESSORY		ACCESSORY
places_panel_hung_fluorescent_light	PLC			1	"Hang Stuff"		
places_panel_hung_pivot_head_task_light	PLC			1	"Hang Stuff"		
places_panel_mounted_fluorescent_light	PLC			1	"VML plc-pmfl"		
places_post_mount_street_light	PLC			1	Mounts powered panels >=18" wide, <63" tall		
places_street_light	PLC			1	"Mounts on Top of Panel" AND Panel >= 63"		
Floor Mounted Lighting			C416	1	Must sit on floor	1	If nothing selected, put at x_pos = click_global x, y_pos = 0, z_pos = click_global_z, y_rot = 0
Lighting Accessories			C416				
places_fluorescent_light_saddle_mount_kit	PLC			1	Requires appropriate top-cap (wood or metal)	???	
places_painted_shelf_task_light_bracket	PLC			*	*(instantiated by premise_shelf)*	*	
places_vertical_storage_task_light_bracket	PLC			???		???	
places_wood_shelf_task_light_bracket	PLC			*	*(instantiated by premise_shelf)*	*	
Organization			A3				
Tackable Surfaces			B437	1	"Tackables"	1	"Hang Stuff"
premise_tackboard	PRM	N		Inh		Inh	
places_grid_tackstrip	PLC	N		n/a	ACCESSORY	n/a	ACCESSORY
places_tackboard	PLC	N		Inh		Inh	
Markable Surfaces			B437	1	"Markables"	1	"Hang Stuff"

SUBSTITUTE SHEET (RULE 26)

Relationship Maps (part 32 of 34)

Class Structure / Component Name	Prod Line	Proper-ties	Inher-its From	Constraint C#	Constraint Relationships	Light Weight L#	Light Weight Relationships
premise_markerboard	PRM	N		Inh		Inh	
places_markerboard	PLC	N		Inh		Inh	
Workflow Devices			B437				
Vertical Workflows			C445				
premise_all_purpose_hook	PRM			n/a	ACCESSORY	n/a	ACCESSORY
premise_lateral_file_drawer_compressor	PRM			n/a	ACCESSORY	n/a	ACCESSORY
premise_lateral_file_drawer_divider	PRM			n/a	ACCESSORY	n/a	ACCESSORY
premise_lateral_file_front_to_back_hanging_bar	PRM			n/a	ACCESSORY	n/a	ACCESSORY
premise_lateral_file_side_to_side_hanging_bar	PRM			n/a	ACCESSORY	n/a	ACCESSORY
premise_pedestal_drawer_divider	PRM			n/a	ACCESSORY	n/a	ACCESSORY
premise_shelf_divider	PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_bar	LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_freestanding_vertical_unit	LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_suspended_vertical_unit	LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
new_views_shelf_divider	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_all_purpose_hook	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_fundamental_pedestal_hanging_bar	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_fundamental_pedestal_side_to_side_divider	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_lateral_file_front_to_back_hanging_bar	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_organization_grid	PLC			n/a	ACCESSORY	n/a	ACCESSORY

Relationship Maps (part 33 of 34)

Class Structure / Component Name	Prod Line	Properties	Inherits From	C#	Constraint Relationships	L#	Light Weight Relationships
places_shelf_divider	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_vertical_storage_unit_grid	PLC			n/a	ACCESSORY	n/a	ACCESSORY
tri_mode_paper_management_bar	PLC			n/a	ACCESSORY	n/a	ACCESSORY
tri_mode_vertical_unit	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_drawer_compressor	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_drawer_divider	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_front_to_back_hanging_bar	PLC			n/a	ACCESSORY	n/a	ACCESSORY
series_950_side_to_side_hanging_bar	PLC			n/a	ACCESSORY	n/a	ACCESSORY
Horizontal Workflows			C445				
premise_pedestal_pencil_tray	PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_freestanding_horizontal_unit	LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_suspended_horizontal_unit	LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_trays	LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_under_shelf_unit	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_freestanding_grid_mailbox	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_fundamental_pedestal_tray	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_grid_mailbox	PLC			n/a	ACCESSORY	n/a	ACCESSORY
places_grid_reference_tray	PLC			n/a	ACCESSORY	n/a	ACCESSORY
tri_mode_divider	PLC			n/a	ACCESSORY	n/a	ACCESSORY
tri_mode_hanger_clip	PLC			n/a	ACCESSORY	n/a	ACCESSORY
tri_mode_horizontal_shelves	PLC			n/a	ACCESSORY	n/a	ACCESSORY
tri_mode_horizontal_unit	PLC			n/a	ACCESSORY	n/a	ACCESSORY

SUBSTITUTE SHEET (RULE 26)

Relationship Maps (part 34 of 34)

Class Structure	Component Name	Prod Line	Proper-ties	Inher-its From	C#	Constraint Relationships	L#	Light Weight Relationships
Diagonal Workflows				C445				
paper_management_freestanding_diagonal_unit		LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
paper_management_suspended_diagonal_unit		LC, PRM			n/a	ACCESSORY	n/a	ACCESSORY
	tri_mode_diagonal_unit	PLC			n/a	ACCESSORY	n/a	ACCESSORY
Workflow Bins				C445				
	places_grid_diskette_bin	PLC			n/a	ACCESSORY	n/a	ACCESSORY
	places_grid_storage_bin	PLC			n/a	ACCESSORY	n/a	ACCESSORY

SUBSTITUTE SHEET (RULE 26)

Although described with reference to a particular system, the present invention operates on any computer system and can be implemented in software, hardware or any combination thereof. When implemented fully or partially in software, the invention can reside, permanently or temporarily, on any memory or storage medium, including but not limited to a RAM, a ROM, a disk, an ASIC, a PROM and the like.

Thus, a graphical user interface for configuring office furniture is provided. One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which are presented for purposes of illustration and not limitation, and the present invention is limited only by the claims that follow.

What is claimed:

1. A method, for use in a user workstation including a pointing device and a visual display unit, for providing a graphical user interface to a computer program for configuring office furniture, the method comprising:

displaying on a screen of the visual display unit at the user's workstation questions regarding user configuration criteria;

in response to said displaying, obtaining configuration criteria from the user and providing the user configuration criteria to the computer program;

displaying in an area on a screen of the visual display unit at the user's workstation a graphical representation of at least one typical furniture configuration satisfying the user configuration criteria;

selecting, with the pointing device, a typical furniture configuration from the at least one typical furniture configuration displayed on the screen;

modifying, using the pointing device, aspects of the selected typical furniture configuration to produce a modified furniture configuration;

displaying on the visual display unit at the user's workstation a graphical representation of the modified furniture configuration;

with the pointing device, selecting a validity checking option to effect checking the validity of the modified furniture configuration; and

in response to said selecting the validity checking option, checking the validity of the modified configuration.

2. A method as in claim 1 wherein the configuration criteria include at least one of:

conferencing criteria;

privacy criteria;

power criteria;

communications criteria;

storage criteria; and

area criteria.

3. A method as in claim 1 wherein the modifying of the selected typical furniture configuration comprises at least one of, for a depicted component of the selected typical furniture configuration:

adding another component to the depiction of the selected typical furniture configuration;

deleting the depicted component from the depiction of selected typical furniture configuration;

repositioning the depicted component of the depicted selected typical furniture configuration;

changing the depicted fabric or finish of the depicted component of the depicted selected typical furniture configuration; and

changing the shape or size of the depicted component of the depicted selected typical furniture configuration.

4. A method as in claim 3 wherein the adding of another component comprises:

on the screen of the visual display unit at the user's workstation, presenting the user with various possible components which can be added; and

by the user,

selecting with the pointing device one of the various possible components; and

on the display depicting the typical furniture configuration, positioning the selected one possible component on the depiction of the current typical furniture configuration.

5. A method as in claim 3 wherein the changing the shape or size of the depicted component comprises, with the pointing device:

selecting the depicted component; and

adjusting the shape or size of the depicted component, whereby the shape or size can only be adjusted to a valid shape or size.

6. A method as in claim 1 further comprising:

with the pointing device, selecting a price option to effect determining a price of the modified configuration; and

in response to said selecting said price option, determining a price of the modified depicted configuration.

7. A method as in claim 1 further comprising:

with the pointing device, selecting a cluster option to effect producing a cluster configuration of the modified typical furniture configuration; and

in response to said selecting said cluster option, producing a cluster configuration of the modified typical furniture configuration; and

displaying on the screen of the visual display unit at the user's workstation a depiction of the cluster configuration.

8. A method as in claim 7 further comprising:

with the pointing device, selecting a price option to effect determining a price of the cluster configuration; and

in response to said selecting said price option, determining the price of the cluster configuration.

9. A method as in claim 7 wherein the producing of a cluster comprises:

determining if the cluster configuration is a valid configuration; and

optimizing the cluster configuration.

10. A method as in claim 1 wherein the checking the validity of the modified configuration comprises optimizing the modified configuration.

11. A method as in claims 9 or 10 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;

merging components in the configuration; and

splitting components in the configuration.

12. A method as in claim 1 wherein the modifying aspects of the selected typical furniture configuration comprises modifying the entire product line of the configuration.

13. A method of configuring office furniture comprising, by computer:

obtaining configuration criteria from a user;

presenting the user with at least one typical furniture configuration satisfying the criteria;

selecting a typical furniture configuration from the at least one typical configuration;

modifying aspects of the selected typical furniture configuration to produce a modified furniture configuration;

producing a cluster configuration of the modified typical furniture configuration;

checking the validity of the cluster configuration; and

determining a price of the cluster configuration.

14. A method of configuring office furniture comprising, by computer:

obtaining configuration criteria from a user;

presenting the user with at least one typical furniture configuration satisfying the criteria;

selecting a typical furniture configuration from the at least one typical configuration;

modifying aspects of the selected typical furniture configuration to produce a modified configuration; and

checking the validity of the modified configuration.

15. A method as in claim 14 wherein the configuration criteria include at least one of:

conferencing criteria;

privacy criteria;

power criteria;

communications criteria;

storage criteria; and

area criteria.

16. A method as in claim 14 wherein the modifying of the selected typical comprises at least one of, for a component of the selected typical:

adding another component to the selected typical furniture configuration;

deleting the component from the selected typical furniture configuration;

repositioning the component of the selected typical furniture configuration;

changing the fabric or finish of the component of the selected typical furniture configuration; and

changing the shape or size of the component of the selected typical furniture configuration.

17. A method as in claim 16 wherein the adding of another component comprises:

presenting the user with possible components which can be added; and

by the user,

selecting one of the possible components; and

positioning the selected one possible component on the current typical furniture configuration.

18. A method as in claim 16 wherein the changing the shape or size of the component comprises:

selecting the component; and

adjusting the shape or size of the component, whereby the shape or size can only be adjusted to a valid shape or size.

19. A method as in claim 14 further comprising:

determining a price of the modified furniture configuration.

20. A method as in claim 14 further comprising:

producing a cluster configuration of the modified typical furniture configuration.

21. A method as in claim 20 further comprising:

determining a price of the cluster configuration.

22. A method as in claim 20 wherein the producing of a cluster comprises:

determining if the cluster configuration is a valid configuration;

optimizing the cluster configuration.

23. A method as in claim 14 wherein the checking the validity of the modified furniture configuration comprises

optimizing the modified furniture configuration.

24. A method as in any one of claims 22 and 23 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;

merging components in the configuration; and

splitting components in the configuration.

25. A method as in claim 14 wherein the modifying aspects of the selected typical comprises modifying the entire product line of the configuration.

26. Computer-readable media tangibly embodying an interface program of instructions executable by the machine to provide a graphical user interface to a computer program for configuring office furniture, the interface program comprising code to effect:

displaying on a screen of a visual display unit at a user's workstation questions regarding user configuration criteria;

in response to said displaying, obtaining configuration criteria from the user;

displaying in an area on a screen of the visual display unit at the user's workstation a graphical representation of at least one typical furniture configuration satisfying the criteria;

selecting, with input from the pointing device, a typical furniture configuration from the at least one typical furniture configurations displayed on the screen;

modifying, using input from the pointing device, aspects of the selected typical furniture configuration to produce a modified furniture configuration;

displaying on the visual display unit at the user's workstation a graphical representation of the modified furniture configuration;

with input from the pointing device, selecting a validity checking option to effect checking the validity of the modified furniture configuration; and

in response to said selecting the validity checking option, checking the validity of the modified furniture configuration.

27. Media as in claim 26 wherein the configuration criteria include at least one of:

conferencing criteria;

privacy criteria;

power criteria;

communications criteria;

storage criteria; and

area criteria.

28. Media as in claim 26 wherein the modifying of the selected typical comprises at least one of, for a depicted component of the selected typical furniture configuration:

adding another component to the depiction of the selected typical furniture configuration;

deleting the depicted component from the depiction of selected typical furniture configuration;

repositioning the depicted component of the depicted selected typical furniture configuration;

changing the depicted fabric or finish of the depicted component of the depicted selected typical furniture configuration; and

changing the shape or size of the depicted component of the depicted selected typical furniture configuration.

29. Media as in claim 28 wherein the adding of another component comprises:

on the screen of the visual display unit at the user's workstation, presenting the user with various possible components which can be added; and

by the user,

selecting with the pointing device one of the various possible components; and

on the display depicting the typical furniture configuration, positioning the selected one possible component on the depiction of the current typical furniture configuration.

30. Media as in claim 28 wherein the changing the shape or size of the depicted component comprises, with input from the pointing device:

selecting the depicted component; and

adjusting the shape or size of the depicted component, whereby the shape or size can only be adjusted to a valid shape or size.

31. Media as in claim 26 the program further comprising code to effect:

with input from the pointing device, selecting a price option to effect determining a price of the modified configuration; and

in response to said selecting said price option, determining a price of the modified depicted configuration.

32. Media as in claim 26 the program further comprising code to effect:

with input from the pointing device, selecting a cluster option to effect producing a cluster configuration of the modified typical furniture configuration;

in response to said selecting said cluster option, producing a cluster configuration of the modified typical furniture configuration; and

displaying on the screen of the visual display unit at the user's workstation a depiction of the cluster configuration.

33. Media as in claim 32, the program further comprising code to effect:

with input from the pointing device, selecting a price option to effect determining a price of the modified configuration; and

in response to said selecting said price option, determining the price of the cluster configuration.

34. Media as in claim 32 wherein the producing of a cluster comprises:

determining if the cluster configuration is a valid furniture configuration; and

optimizing the cluster configuration.

35. Media as in claim 26 wherein the checking the validity of the modified configuration comprises

optimizing the modified configuration.

36. Media as in claim 35 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;

merging components in the configuration; and

splitting components in the configuration.

37. Media as in claim 34 wherein the optimizing of a configuration comprises at least one of:

removing redundant components from the configuration;

merging components in the configuration; and

splitting components in the configuration.

38. Media as in claim 26 wherein the modifying aspects of the selected typical comprises modifying the entire product line of the configuration.

39. Computer-readable media as in any one of claims 26 to 38 wherein said media comprise at least one of a RAM, a ROM, a disk, an ASIC and a PROM.

40. A computer-assisted furniture configuration system comprising:

(A) a visual display unit;

(B) a pointing device; and

(C) interface means for providing a graphical user interface to said configuration system, the interface means comprising means to effect:

displaying on a screen of the visual display unit at the user's workstation questions regarding user configuration criteria;

in response to said displaying, obtaining configuration criteria from the user and providing the user configuration criteria to the computer program;

displaying in an area on a screen of the visual display unit at the user's workstation a graphical representation of at least one typical furniture configuration satisfying the user configuration criteria;

selecting, with the pointing device, a typical furniture configuration from the at least one typical furniture configurations displayed on the screen;

modifying, using the pointing device, aspects of the selected typical furniture configuration to produce a modified furniture configuration;

displaying on the visual display unit at the user's workstation a graphical representation of the modified furniture configuration;

with the pointing device, selecting a validity checking option to effect checking the validity of the modified furniture configuration; and

in response to said selecting the validity checking option, checking the validity of the modified configuration.

FIG. 1

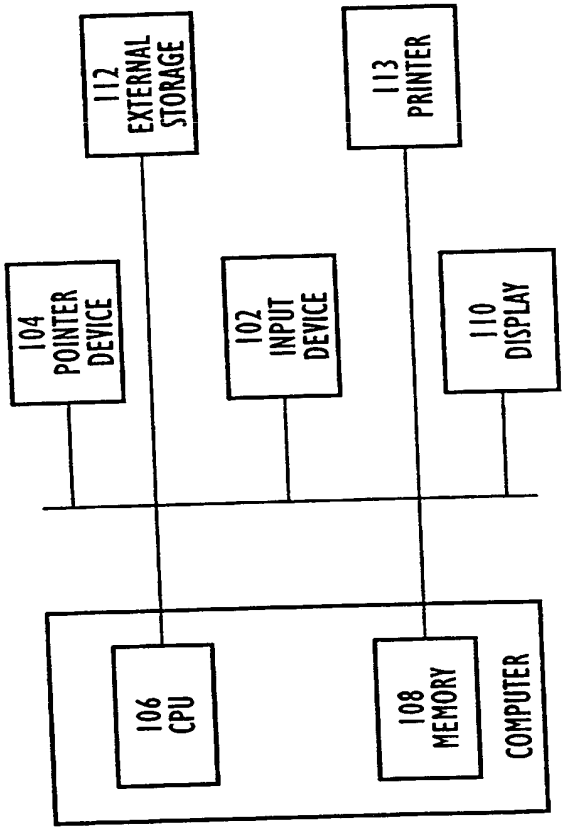

100
112 EXTERNAL STORAGE
113 PRINTER
104 POINTER DEVICE
102 INPUT DEVICE
110 DISPLAY
106 CPU
108 MEMORY
COMPUTER

FIG. 2

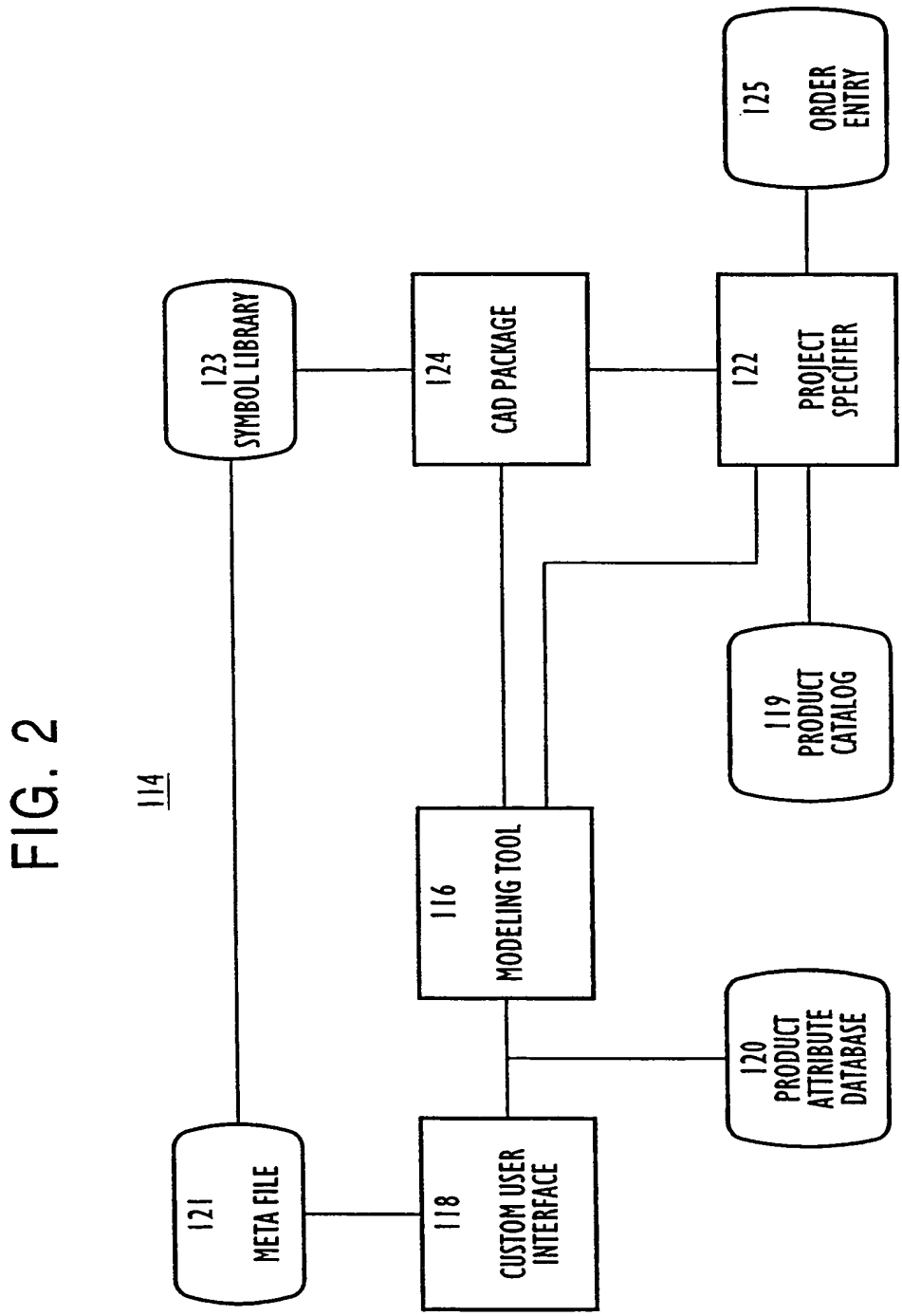

114
123 SYMBOL LIBRARY
124 CAD PACKAGE
122 PROJECT SPECIFIER
125 ORDER ENTRY
119 PRODUCT CATALOG
116 MODELING TOOL
120 PRODUCT ATTRIBUTE DATABASE
121 META FILE
118 CUSTOM USER INTERFACE

FIG. 3

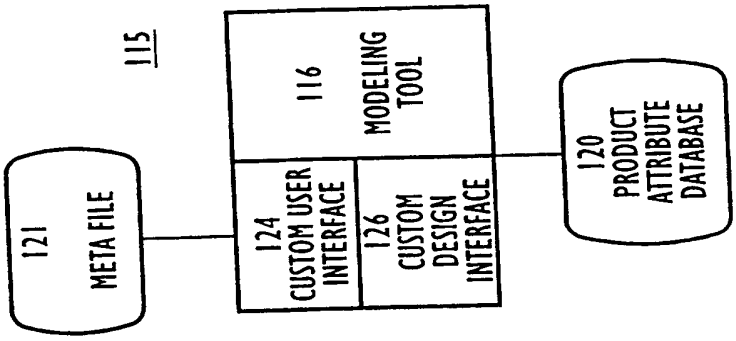

115
121
META FILE
124
CUSTOM USER INTERFACE
126
CUSTOM DESIGN INTERFACE
116
MODELING TOOL
120
PRODUCT ATTRIBUTE DATABASE

FIG. 4

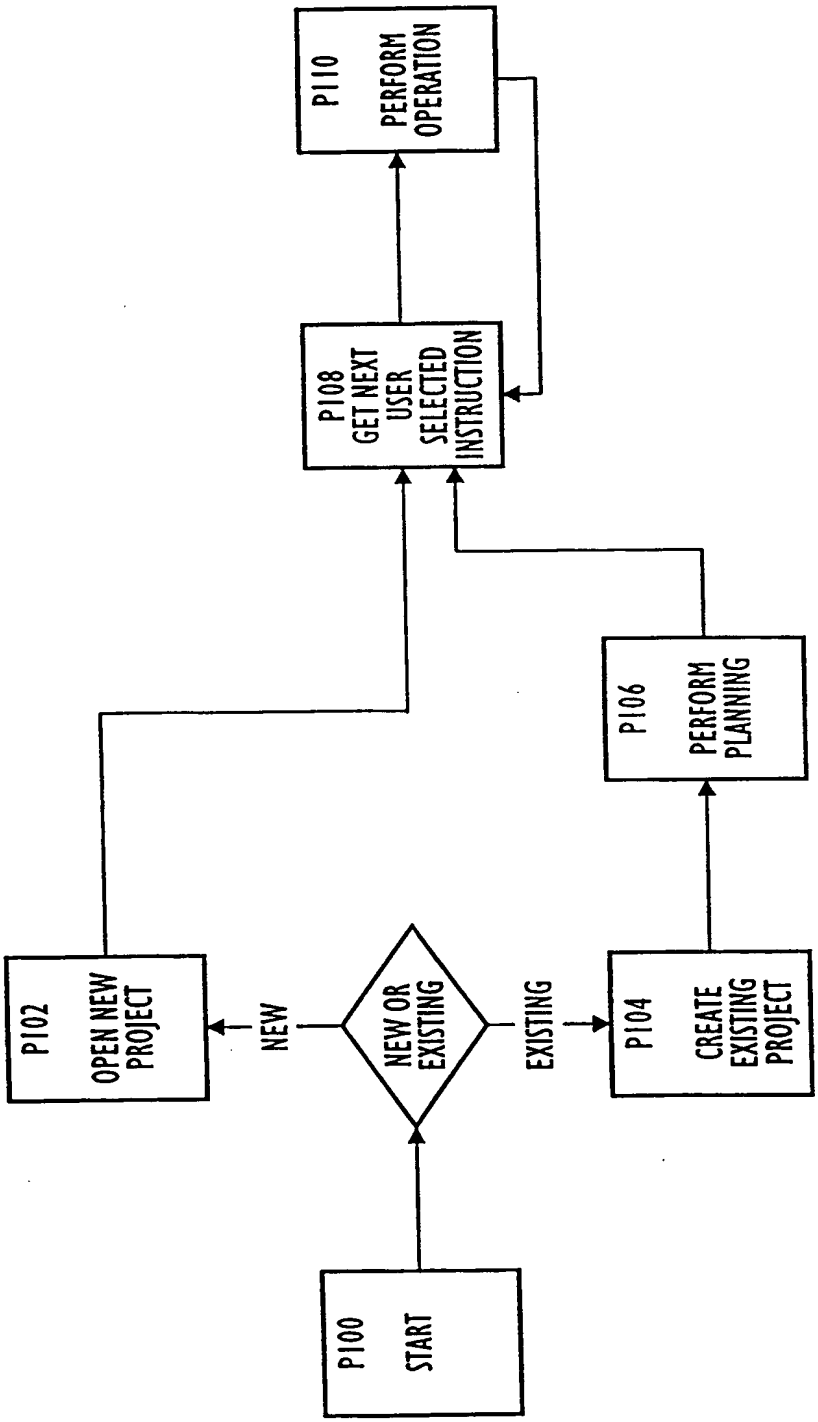

P100
START
NEW OR EXISTING
NEW
EXISTING
P102
OPEN NEW PROJECT
P104
CREATE EXISTING PROJECT
P106
PERFORM PLANNING
P108
GET NEXT USER SELECTED INSTRUCTION
P110
PERFORM OPERATION

FIG. 5

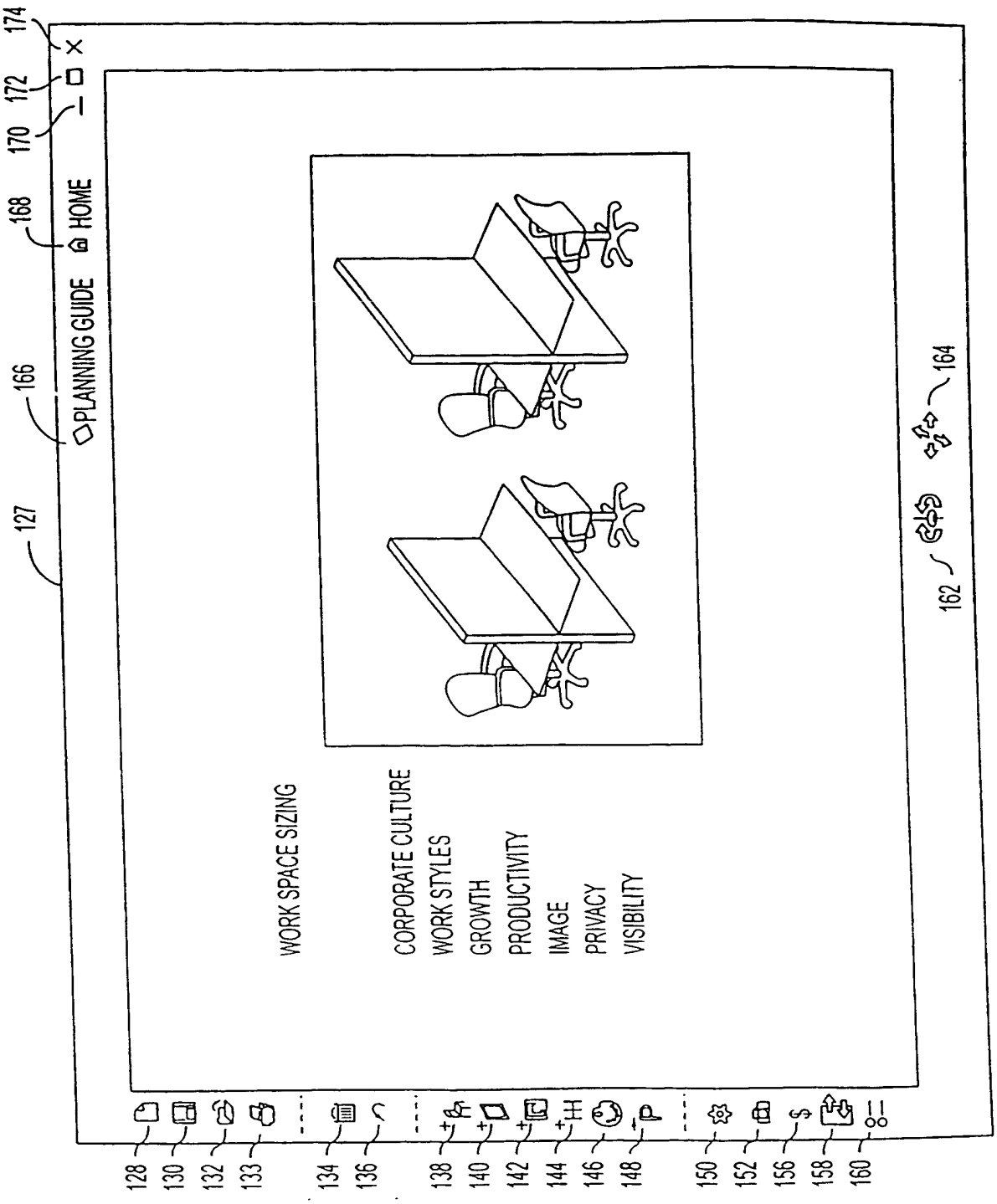
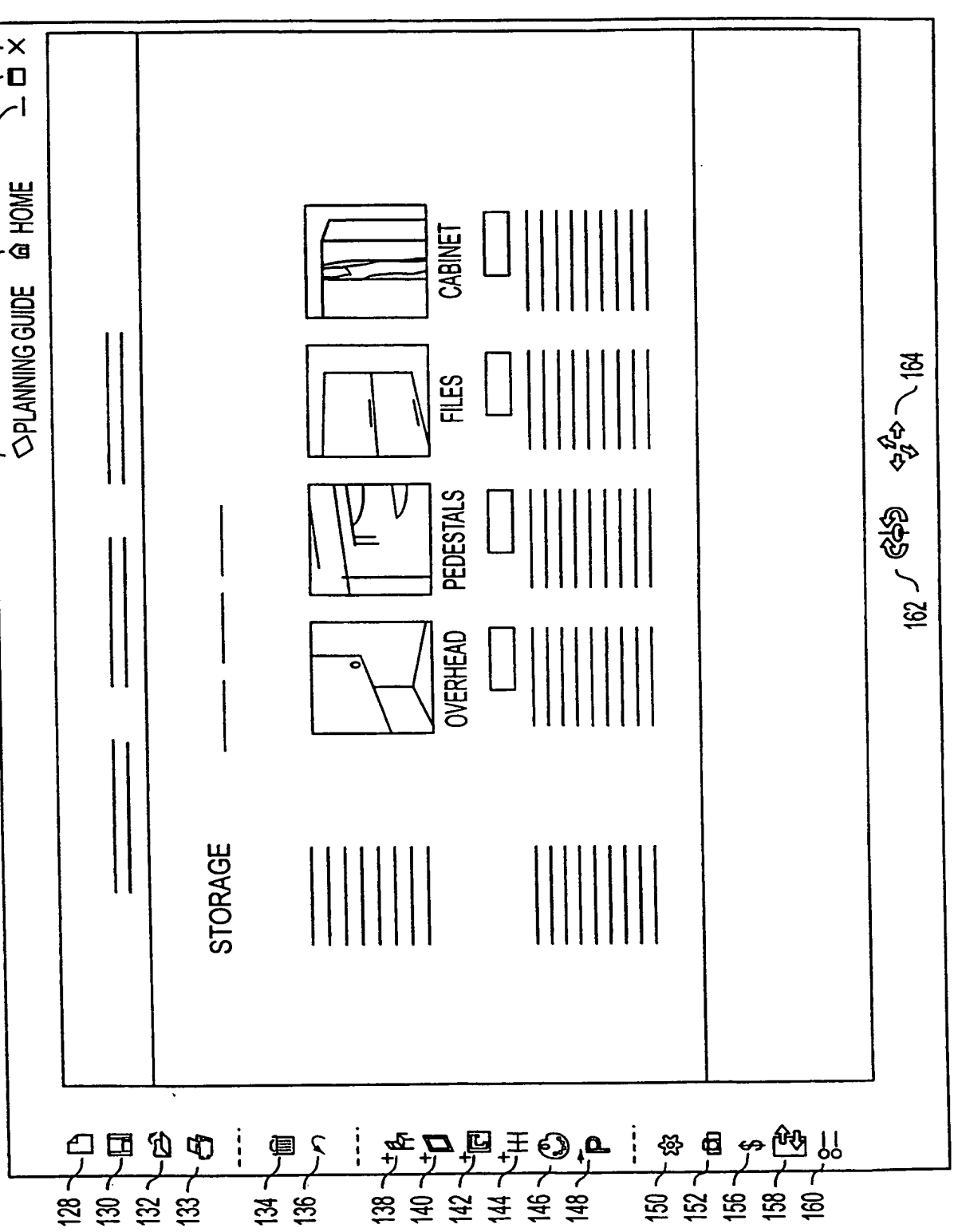

174
172
170
168
HOME
PLANNING GUIDE
166
127
164
162
WORK SPACE SIZING
CORPORATE CULTURE
WORK STYLES
GROWTH
PRODUCTIVITY
IMAGE
PRIVACY
VISIBILITY
128
130
132
133
134
136
138
140
142
144
146
148
150
152
156
158
160

FIG. 6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PLANNING GUIDE
HOME
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PEDESTALS
OVERHEAD
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132
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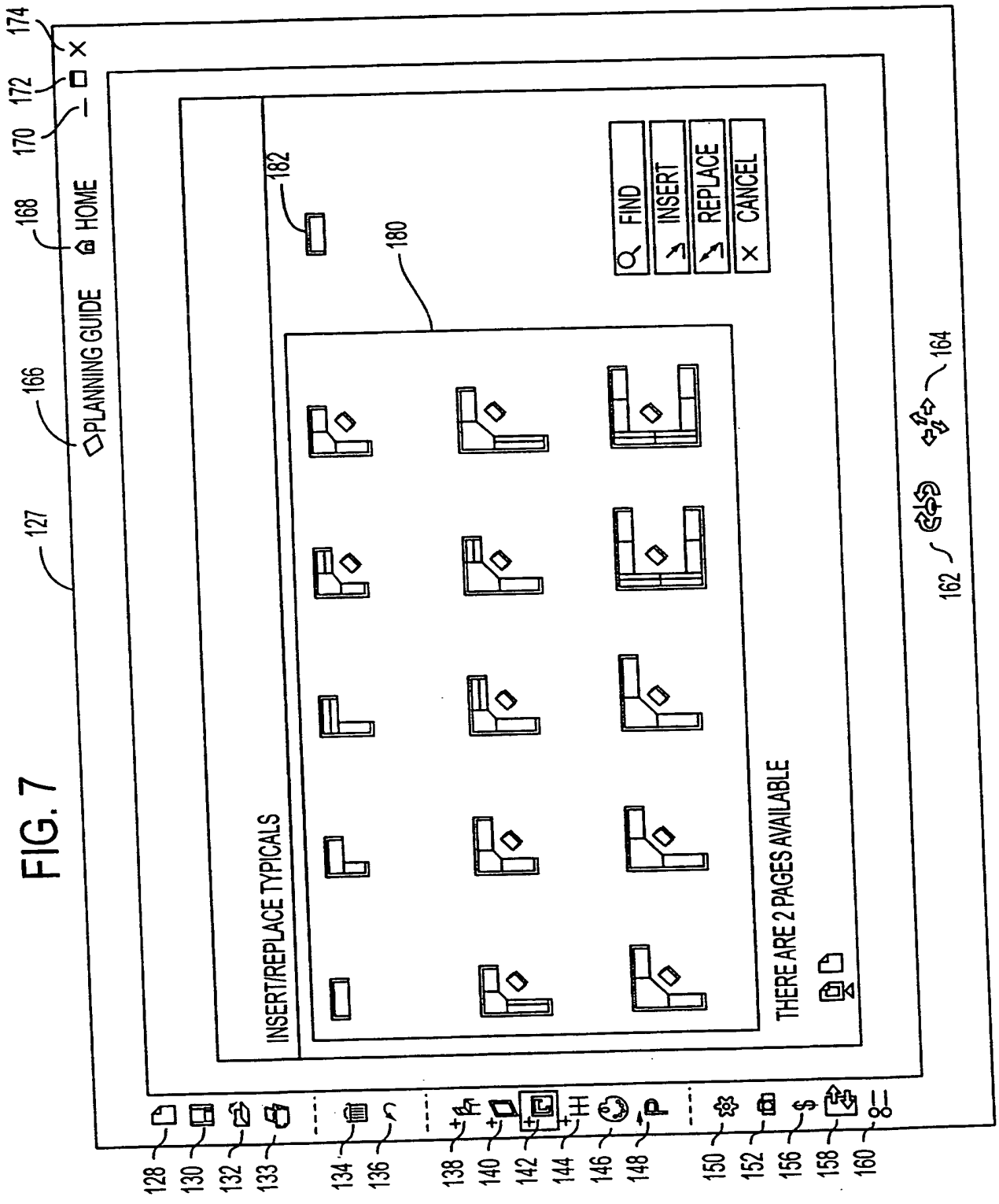
FIG. 7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168
HOME
PLANNING GUIDE
166
127
182
180
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INSERT
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CANCEL
INSERT/REPLACE TYPICALS
THERE ARE 2 PAGES AVAILABLE
164
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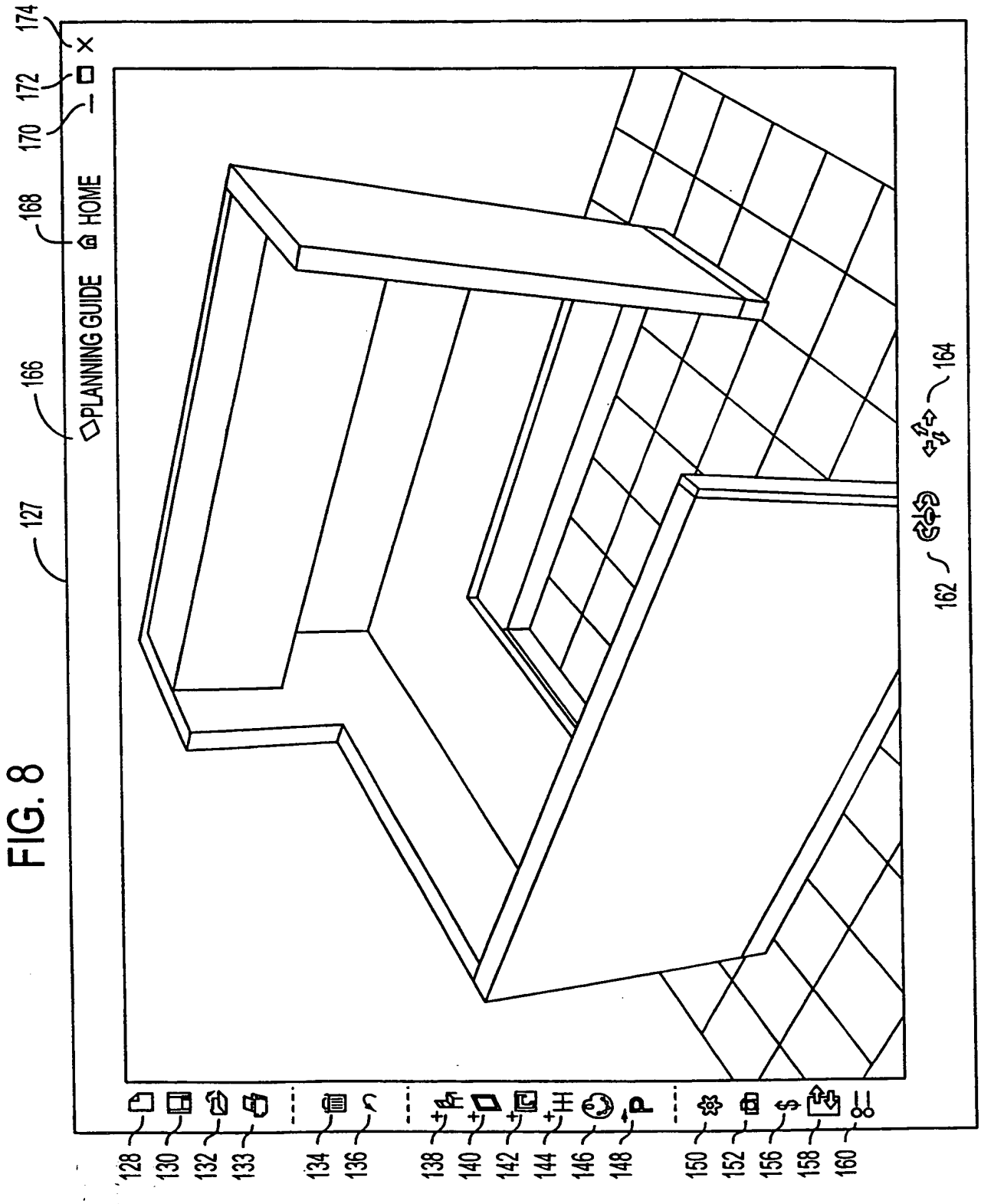
FIG. 8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HOME
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PLANNING GUIDE
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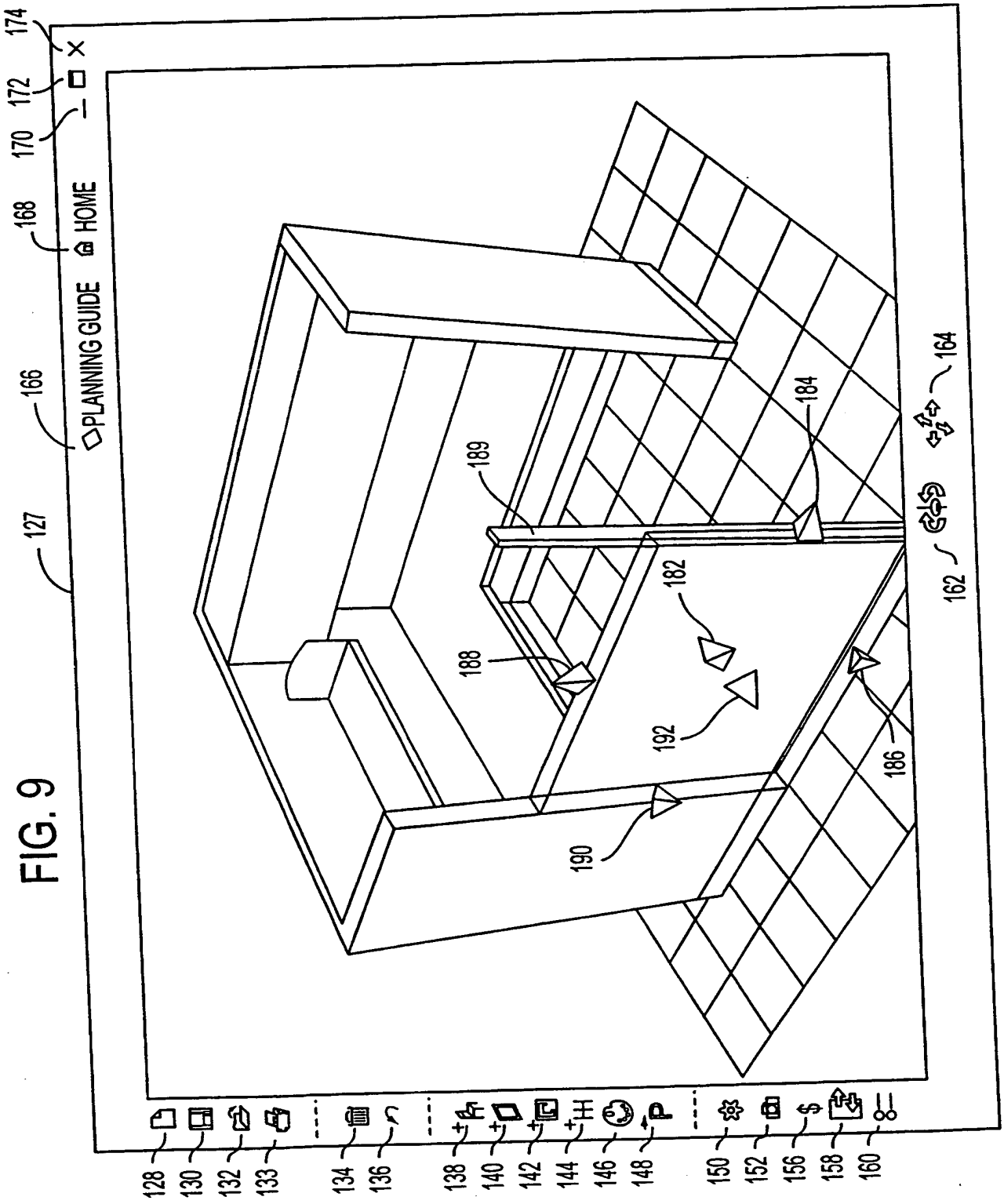
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PLANNING GUIDE
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FIG. 9

FIG. 10

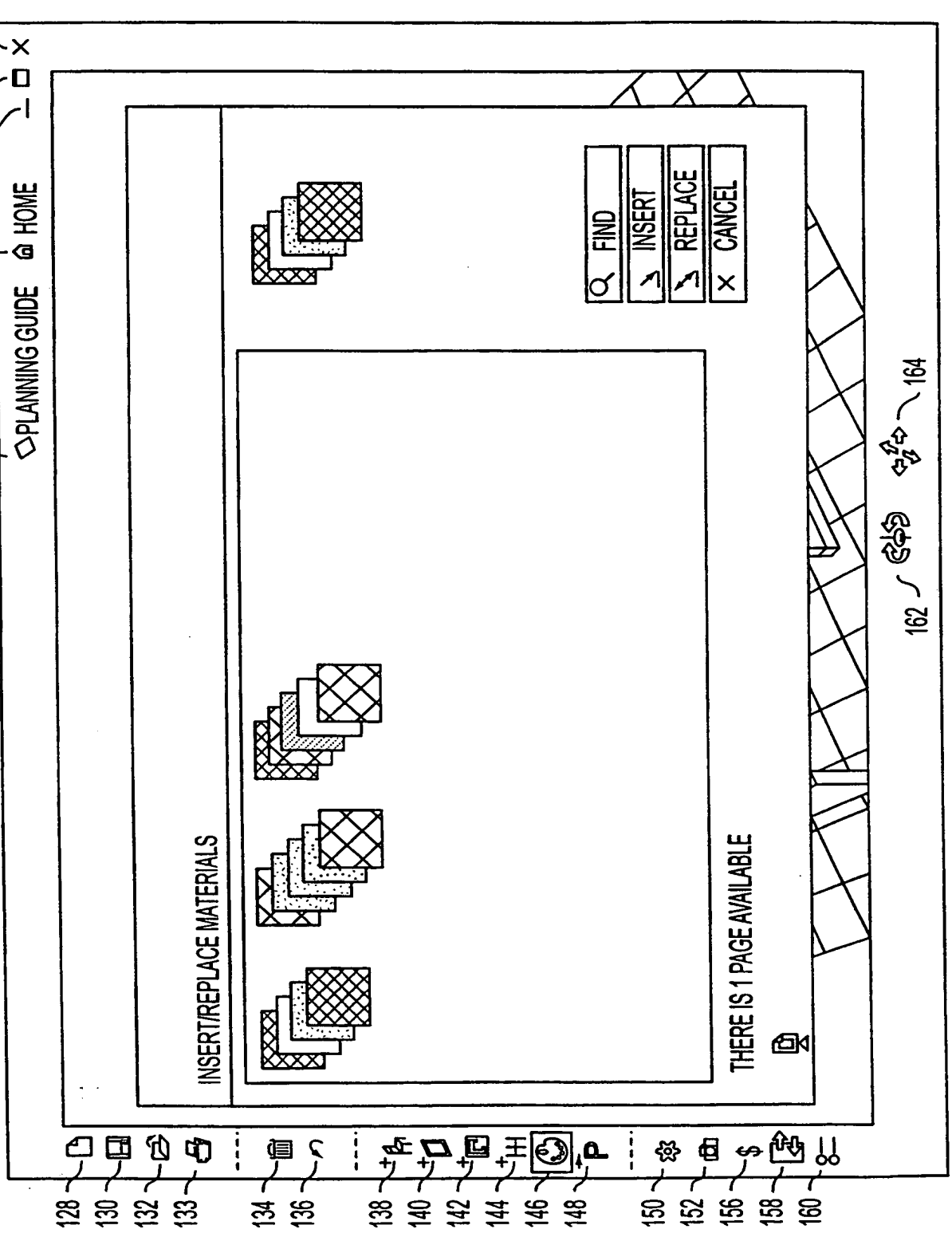
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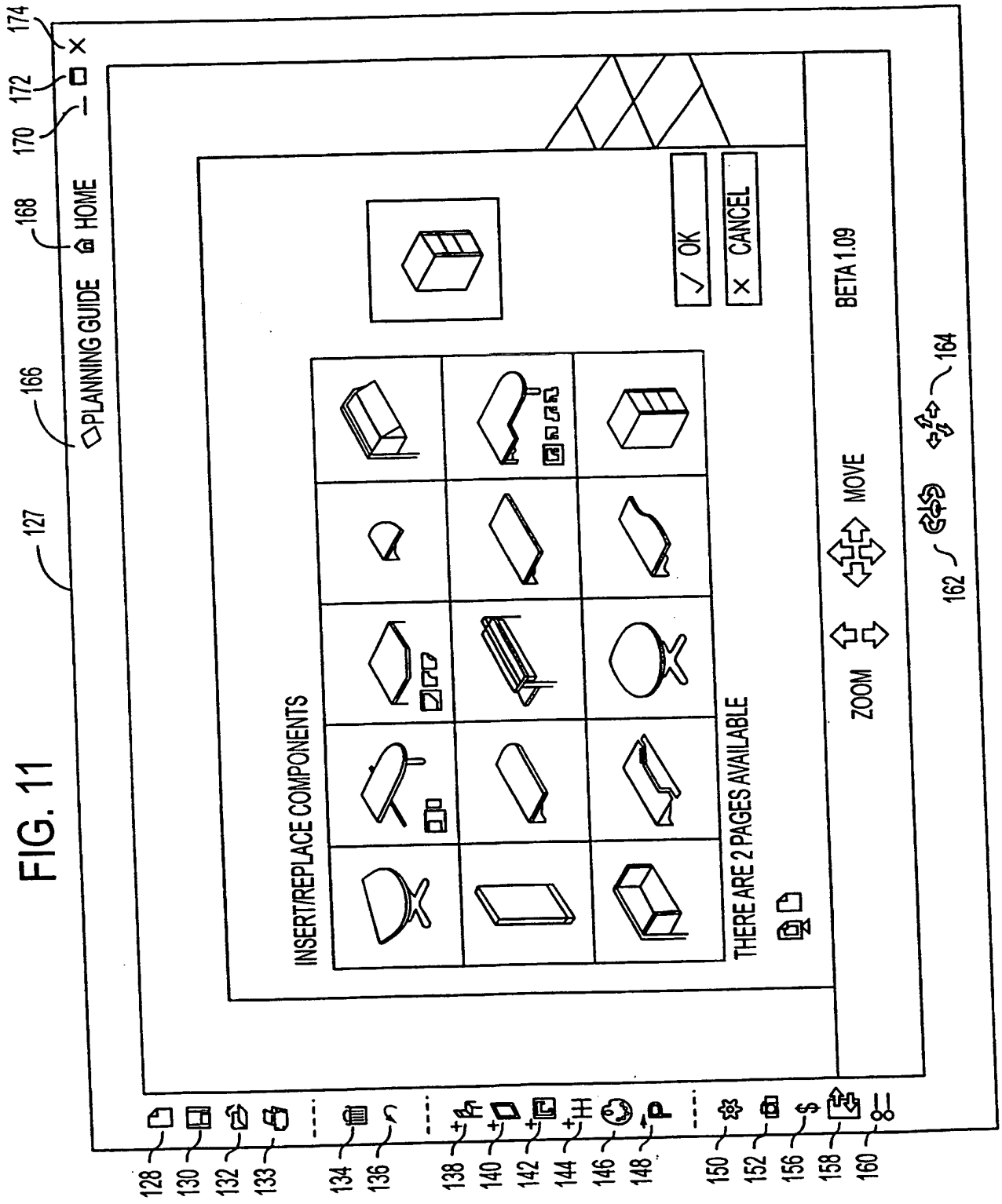
FIG. 11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166
127
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BETA 1.09
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ZOOM
THERE ARE 2 PAGES AVAILABLE
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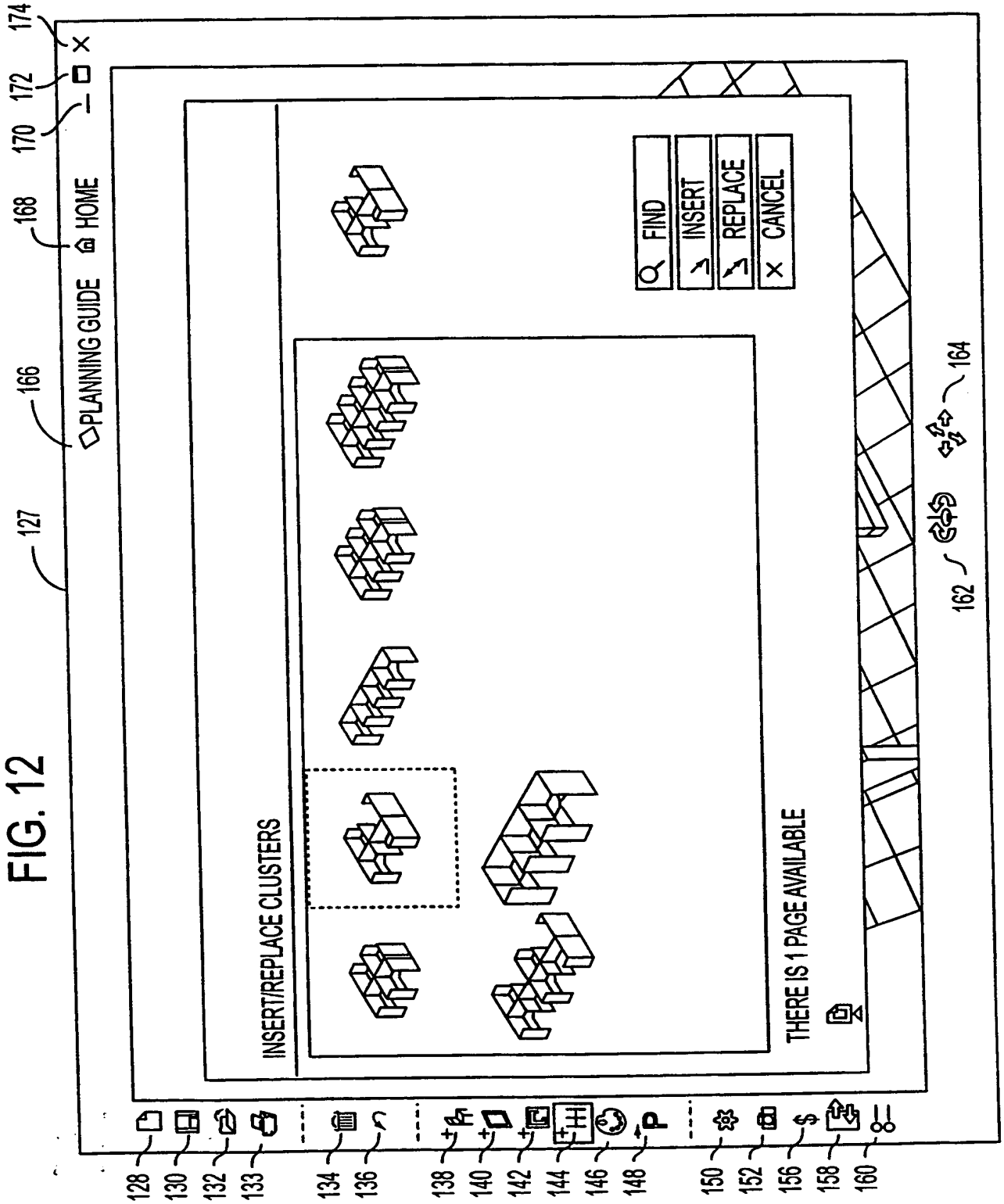
FIG. 12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PLANNING GUIDE
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REPLACE
CANCEL
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162
INSERT/REPLACE CLUSTERS
THERE IS 1 PAGE AVAILABLE
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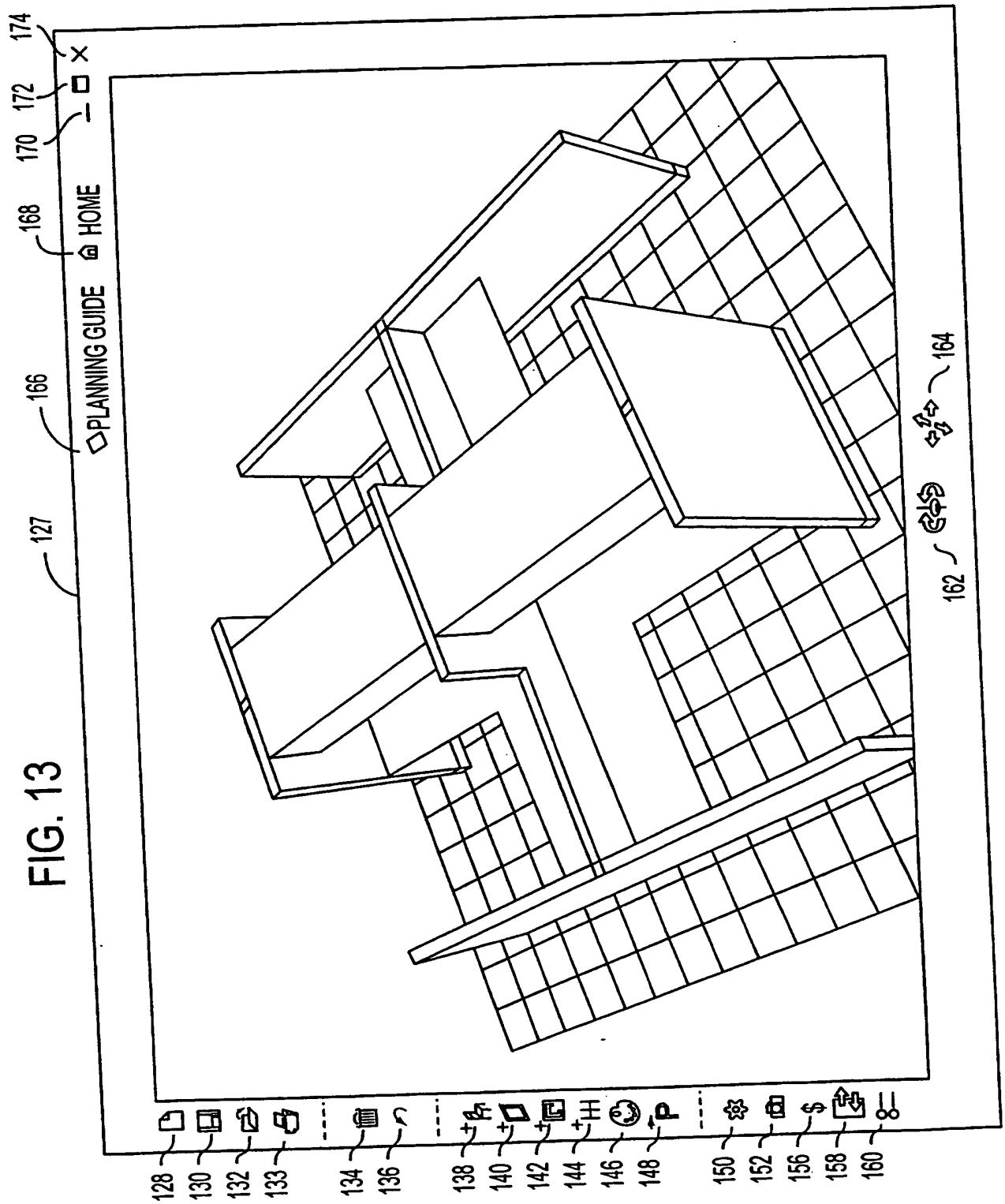
FIG. 13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HOME
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PLANNING GUIDE
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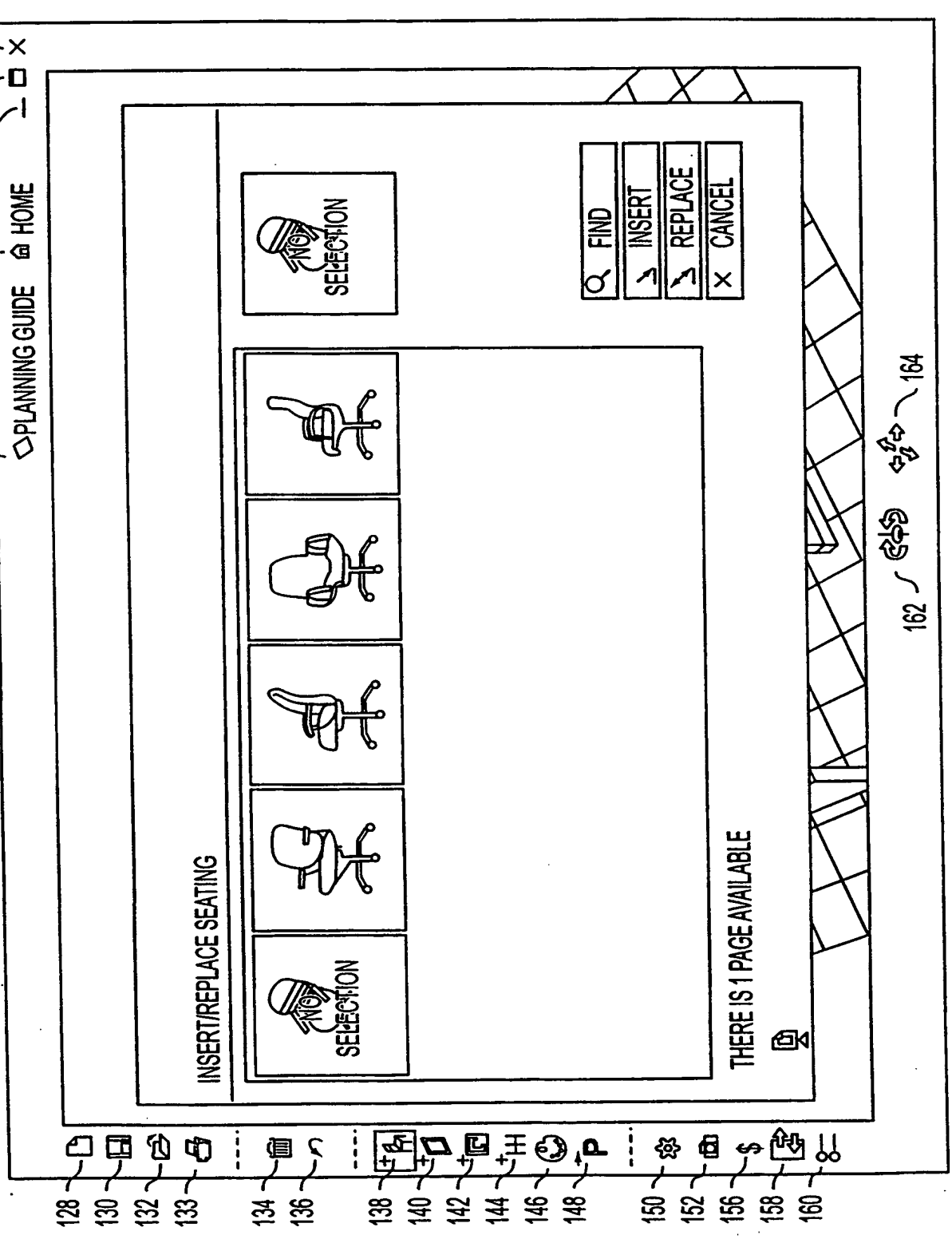
FIG. 14


174
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168
HOME
PLANNING GUIDE
166
127
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NO SELECTION
FIND
INSERT
REPLACE
CANCEL
THERE IS 1 PAGE AVAILABLE
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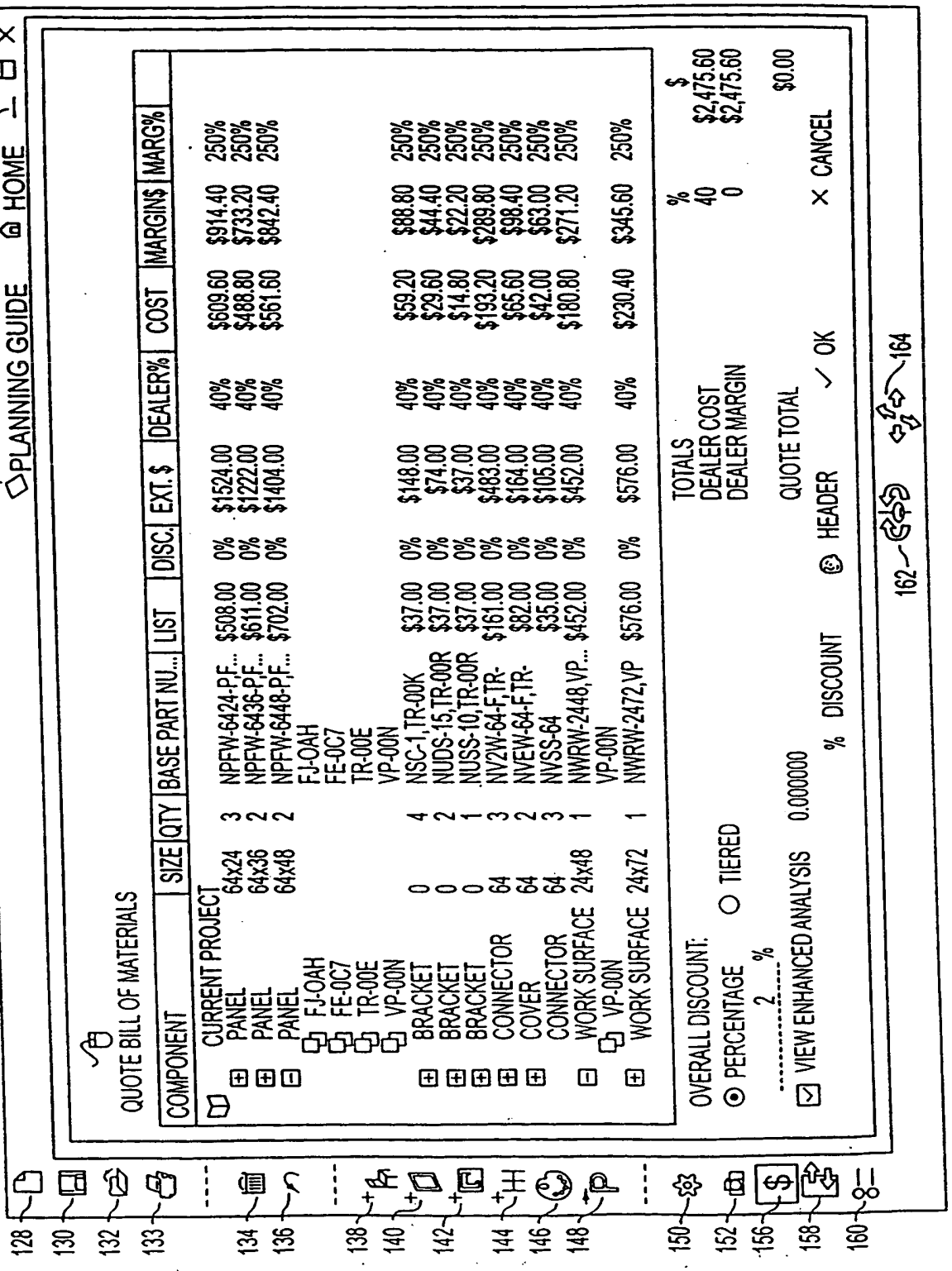
FIG. 15


PLANNING GUIDE
HOME
QUOTE BILL OF MATERIALS
COMPONENT
SIZE
QTY
BASE PART NU...
LIST
DISC.
EXT.$
DEALER%
COST
MARGIN$
MARG%
CURRENT PROJECT
PANEL 64x24 3 NPFW-6424-P,F... $508.00 0% $1524.00 40% $609.60 $914.40 250%
PANEL 64x36 2 NPFW-6436-P,F... $611.00 0% $1222.00 40% $488.80 $733.20 250%
PANEL 64x48 2 NPFW-6448-P,F... $702.00 0% $1404.00 40% $561.60 $842.40 250%
FJ-OAH $59.20 $88.80 250%
FE-0C7 $29.60 $44.40 250%
TR-00E $14.80 $22.20 250%
VP-00N $193.20 $289.80 250%
BRACKET 0 4 NSC-1,TR-00K $37.00 0% $148.00 40% $59.20 $88.80 250%
BRACKET 0 2 NUDS-15,TR-00R $37.00 0% $74.00 40% $29.60 $44.40 250%
BRACKET 0 1 NUSS-10,TR-00R $37.00 0% $37.00 40% $14.80 $22.20 250%
CONNECTOR 64 3 NV2W-64-F,TR- $161.00 0% $483.00 40% $193.20 $289.80 250%
COVER 64 2 NVEW-64-F,TR- $82.00 0% $164.00 40% $65.60 $98.40 250%
CONNECTOR 64 3 NVSS-64 $35.00 0% $105.00 40% $42.00 $63.00 250%
WORK SURFACE 24x48 1 NWRW-2448,VP... $452.00 0% $452.00 40% $180.80 $271.20 250%
VP-00N $230.40 $345.60 250%
WORK SURFACE 24x72 1 NWRW-2472,VP $576.00 0% $576.00 40%
TOTALS % $
DEALER COST 40 $2,475.60
DEALER MARGIN 0 $2,475.60
OVERALL DISCOUNT:
PERCENTAGE TIERED
2 %
VIEW ENHANCED ANALYSIS 0.000000
% DISCOUNT
QUOTE TOTAL $0.00
HEADER
OK
CANCEL
127
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INTERNATIONAL SEARCH REPORT

Int. ..ional Application No
PCT/US 98/09890

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F17/50 G06T17/40 G06F17/60

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 111 392 A (MALIN STUART B) 5 May 1992 see abstract; claims 1-9 see column 3, line 1 - line 17 see column 1, line 52 - column 2, line 34 see column 3, line 39 - line 60; figure 4 see column 5, line 10 - line 33; figures 1,9	1-40
X	US 5 293 479 A (SMITH JIM ET AL) 8 March 1994 see abstract see column 2, line 7 - line 44 see column 3, line 21 - line 28 see column 9, line 37 - column 10, line 15; figure 1	1,13,14, 26,40

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 August 1998	20/08/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Suendermann, R

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte . .onal Application No
PCT/US 98/09890

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5111392 A	05-05-1992	NONE	
US 5293479 A	08-03-1994	AU 2309792 A	11-02-1993
		CA 2112977 A	21-01-1993
		EP 0598748 A	01-06-1994
		WO 9301557 A	21-01-1993